Universidad Loyola Andalucía

Programa de Doctorado: Ciencia de los Datos

Cardiac rehabilitation women non-adherence

Presentada por Davinia María Resurrección Mena para optar al título de doctora

por la Universidad Loyola Andalucía

Directores:

Dra. Emma Motrico Martínez

Dra. Patricia Moreno Peral

Dr. Carlos R. García Alonso

Tutor:

Dr. Alfonso Carlos Martínez Estudillo

"I wish I was home", she said miserably.

She tried so hard to be brave, to be fierce as a wolverine and all, but sometimes she felt she was a little girl after all.

George R.R. Martin, A Clash of Kings

Agradecimientos

Esta tesis no es un compendio de artículos. Más bien, es un compendio de personas, viajes y momentos. Gracias a ese viaje de ida y vuelta con lágrimas al compás de un 3x4. Gracias a *Emma* y a *Carlos* por confiar en mí en aquella entrevista en febrero y permitirme cumplir este deseo. A *Patri* por aceptar embarcarse con nosotros en este proyecto tan bonito del que todos hemos aprendido tanto. A *María Rubio,* por contestar cada email con una sonrisa y enseñarme el aspecto cualitativo de la ciencia. A *Alfonso Carlos*, por ser el tutor más divertido.

Entrar en la Universidad Loyola Andalucía incluyó muchos viajes al sótano y a los edificios F y G, acompañándolos cada mañana en la sonrisa y buen querer de la gente que la forman, *Patri, Javi's, Curro, Fran, Paco, Moni, Eva, Teresa,* y tantos que sabéis quiénes sois. Hay otros viajes para los que se necesitan compañeros que te hagan reír, te permitan llorar y gritar, y te den una solución sin pedirla. No podría haber imaginado mejores compañeros que *Yole, Marco, Bea, Mar, Manolo, Pedro y Paloma.* Gracias por todo lo que habéis hecho sin fatigaros y desde el corazón. En los viajes más cortos, de mesa a mesa en el Departamento de Psicología, gracias a los compañeros que han aportado conocimiento, crítica y muchos almuerzos y cafés. Especialmente gracias a *Sandra,* por ser un apoyo y un empuje en todas mis decisiones, y a *Irene y Alina* por ayudarme en este proyecto.

Las vueltas al mundo en cada cuatrimestre con mis alumnos de Córdoba y Sevilla me han enseñado a abrazar mi pasión por la docencia. Las risas, miradas tras la pantalla del portátil y algún enfado corrigiendo prácticas, han hecho que el camino del doctorado sea gratificante y en ocasiones han dotado de sentido a la realidad. Gracias en particular a *Paula*, por ayudarme en muchos momentos de esta tesis, por ser tan tú y por llevar por bandera siempre tus valores.

Sumando la distancia que hay entre las ciudades en las que vivíamos antes, hay más de 10000 kilómetros. Cuántas vueltas hemos tenido que dar sin saber que Sevilla nos reuniría en una parada del camino para montar a *los trotamúsicos*. La palabra gracias se queda corta para expresar todo lo que habéis hecho. Pido para cuando sea mayor ser tan tranquila y divertida como *Sergio,* llegar a tener la mitad del corazón de *Carla,* la fuerza y dedicación de *Gemma* (y alguien que baile como *Manolo)*, el arranque de *Pili,* y la valentía de *Desi.* A ti *Desi,* gracias por permitirme acompañarte en tu vida desde hace tantos años, gracias porque "al final veré como merece la pena". A *Jose* por recordarnos en cada viaje que hace el verdadero motivo de vivir y el precio que tiene el sacrificio.

Para hacer internacional este compendio de momentos, tuve la suerte de vivir una de las mejores épocas de mi vida en mi adorada Lisboa. Muito obrigada ao Professor *José Miguel Caldas de Almeida e Graça Cardoso*, e obrigada por estar tão familiares e me receber. *Ana, Diana and Manuela,* thank you for my first gluten-free cone, for being geek and, especially for being my Portuguese family. En la internacionalización portuguesa conocí a muchos españoles con los que he vivido, reído, llorado y hecho de comer tantas veces. En especial, a *Quique* por abrirme la puerta aquel día. A *Fran* por las risas, los bailes y por no decir nunca que no a ninguna locura. A *Jose,* gracias. Me has devuelto la alegría e inocencia perdidas, las horas de risa sin sentido y el mejor mirador. Gracias por tatuar Lisboa no sólo en mi piel sino en el corazón.

Doscientos cuarenta y cinco kilómetros lejos de mi casa, viajar de Sevilla a Málaga no ha sido siempre fácil, sobre todo después de tener a *Fry* conmigo. Pero todos y cada uno de los kilómetros hechos en estos años han merecido la pena. Los perri-paseos con *Fer* y su capacidad para darme serenidad. Ver *a las niñas*, con nuestros cafés y almuerzos, sábados en la playa. Con especial cariño a *Leti,* por hacer de mi pisito de Sevilla su segunda casa. En otras ocasiones los kilómetros se han recorrido por ver al equipo de Fuengirola, para poner en vivo y en directo horas de charla por whatsapp. *David, Xane y Alma; Carva y Ali; Luis, Vivi y Pablo; Ángeles, Oli y Ainu.* Gracias por entender mis silencios y mis gritos, por criar y hacer más grande a mi mini-yo, por enseñarme cada día que la vida es aquí y ahora. En especial a Oli, por el precioso diseño de la portada. Otras veces, echas de menos el abrazo, las risas en directo y el tacto frío de una sin gluten junto a los mejores copilotos que alguien puede querer. *Antonio,* mi *nito,* espero poder regalarte camisetas frikis toda tu vida y que te sigan saliendo tan ricas las lasañas. Junto a *Pablo*, por quererme como una hermana, una cuñada, una más de vuestra familia. Y a *Cris.* Eres amor y alegría, llanto y bondad, diversión y calma, eres un vino tinto arraigado. Gracias por apoyarme en cada paso y por haber apostado por mí desde hace tantos años.

Aunque esta tesis es un alto en el camino, no comenzó hace tres años, sino en los 80. A mi abuela, a mi familia. *Mis padres*, conductores incansables de un camión que nunca ha echado el freno de mano y siempre ha sabido sortear los caminos más tortuosos. Sin vuestro arroje y cariño no sería quién soy. Gracias. Y gracias por haber puesto en la sillita de al lado a mi hermana. Gracias *Yasmina.* Por empeñarte en pasarte las partidas de la vida en modo difícil, por luchadora y valiente, por darme motivos para seguir, por darle sentido a ser Tati.

Al añadido del compendio de familiares y amigos que han sabido estar presentes y ausentes, esta tesis no habría podido realizarse sin el apoyo y ayuda de los fisioterapeutas, enfermeros y cardiólogos del Hospital San Cecilio (Granada), Hospital Puerta del Mar (Cádiz), y Hospital

Nuestra Señora de Valme (Sevilla). Especialmente, gracias a *Pascual, José Antonio y al Dr. Luis Pastor,* por abrazar desde el primer minuto este proyecto como suyo propio. Detrás del trabajo que realizan tantos profesionales de la sanidad se encuentran los rostros de las pacientes. Ha sido un honor darle voz a las mujeres con enfermedad cardiovascular para que se oigan sus necesidades, sus miedos, sus inquietudes. Gracias por abrirme la puerta de vuestros hogares. Finalmente, con permiso de Pascual, tomaré una frase que me dijo "las mujeres sois la llave para el cambio".

Gracias al Ayuntamiento de Sevilla por el reconocimiento del trabajo de esta tesis en 2017 con el Premio Joven a la Cultura Científica en la modalidad grado y postgrado en el ámbito de las Ciencias Humanas y Sociales.

Finally, many thanks for the evaluation of this work as international expert reviewers. Thanks to the thesis committee for the effort they invested in the assessment of this work.

Contents

List of figures and tables

General abstract

The main objective of this thesis, presented as a compendium of publications, was to provide insight into the problem of non-adherence to cardiac rehabilitation (CR) programs in women. This thesis contains **four chapters.**

Chapter 1 presents an overview of cardiovascular disease and its risk factors. In addition, a description of secondary prevention strategies and adherence issues are reviewed. Finally, the research questions and objectives of the thesis are presented.

Chapter 2 is composed of three articles. **Article I** aimed to synthesize evidence about factors associated with non-adherence to CR programs. For this purpose, a systematic review of prospective cohort studies that evaluated the factors associated with nonparticipation in and/or dropping out from CR programs was carried out. Cohort studies were identified through electronic databases, reference lists were checked, and experts were consulted. Methodological quality was assessed and outcomes were extracted in duplicate. In the systematic review, 43 prospective cohort studies were included, with a total sample of 63,197 patients from three continents (Europe, America, and Oceania) and from ten countries (Australia, Belgium, Canada, Denmark, Ireland, New Zealand, Poland, Switzerland, the United Kingdom, and the United States). Factors associated with nonparticipation in/and dropout from CR were grouped into six-level categories: intrapersonal factors, clinical factors, interpersonal factors, logistical factors, CR program factors, and health system factors. We found that clinical factors, CR program factors, and health system factors were mainly assessed as factors associated with nonparticipation in CR. Moreover, we found differences between the factors associated with nonparticipation in and dropout from CR programs.

Article II aimed to synthesize the evidence about barriers reported by women with cardiovascular diseases affecting their nonparticipation in and/or dropping out from CR programs. For this purpose, a systematic review of studies that evaluated the barriers perceived by women with cardiovascular diseases associated with their nonparticipation in and/or dropping out from CR programs was carried out. Studies were identified through electronic databases, reference lists were checked, and experts were consulted. Methodological quality was assessed and outcomes were extracted in duplicate. Twenty-four studies (17 descriptive, six qualitative, and one randomized controlled trial) were included in the systematic review. Barriers were grouped into five broad categories: intrapersonal barriers (self-reported health, health beliefs, lack of time, motivation, and religious reasons); interpersonal barriers (lack of family/social support and work conflicts); logistical barriers (transport, distance, and availability of personal/community resources); CR program barriers (services offered, group format, exercise component, and CR sessions); and health system barriers (lack of referral, cost, negative experiences with the health system, and language). Differences between the barriers related to nonparticipation in and dropout from CR programs were found.

Article III aimed to describe the barriers women faced regarding dropout from CR programs. For this purpose, a qualitative study that described the reasons for women's dropout from CR from the perspective of both women and cardiovascular professionals was conducted with semi-structured interviews and a focus group. Five general themes were identified that illustrated reasons for dropout from CR among women: intrapersonal reasons (self-reported health, self-reported mental health, health beliefs); interpersonal reasons (family caregiver role, work conflicts); logistical reasons (transport distance); CR program characteristics (perception of

the objective of CR, exercise component, inconvenient timing, CR equipment); and health system reasons (financial assistance for transport, long waiting list). Cardiovascular professionals identified similar barriers to CR completion in women.

Chapter 3 reports a general discussion based on the three articles. Overall, non-adherence process is complex. The results of this thesis show that women are at higher risk for CR non-adherence, facing barriers that might influence both nonparticipation in and dropout from CR. In addition, strengths and limitations of the present dissertation are provided.

Finally, **Chapter 4** provides conclusions, future research lines and practical implications to address the problem of non-adherence to CR programs in women. Health system policies should contemplate gender-specific issues in CR. The results of this thesis will enable policy makers to design specific strategies to maximize participation and completion of CR in women.

The articles included in this dissertation have either been published, in press or in review to high impact international journals indexed in Journal of Citation Reports first quartile. They have been included in this dissertation in their published or submitted form.

Chapter 1

Introduction and objectives

1.1. Cardiovascular diseases

Cardiovascular diseases are a group of disorders of the heart and blood vessels. A common pathogenic mechanism in of all cardiovascular diseases is atherosclerosis, and its evolution is influenced by several well-established risk factors. Cardiovascular diseases include coronary heart disease, cerebrovascular disease, peripheral arterial disease, rheumatic heart disease, congenital heart disease, deep vein thrombosis, and pulmonary embolism (World Health Organization [WHO], 2017a). Coronary heart disease is the most common type of heart disease, and it may make everyday activities more difficult, impair sexual function, and cause a decrease in health-related quality of life (Anderson & Taylor, 2014).

Regarding the definition and treatment of cardiovascular diseases, the American Heart Association (AHA) introduced the concept of cardiovascular health (Lloyd-Jones et al., 2010), defined as:

> "The absence of clinically manifest cardiovascular diseases together with the simultaneous presence of optimal levels of all seven metrics, including not smoking and having a healthy diet pattern, sufficient physical activity, normal body weight, normal levels of total cholesterol, blood pressure, and fasting blood glucose, in the absence of drug treatment" (Benjamin et al., 2017, p. 16)

Cardiovascular health is characterized by these seven metrics, called Life's Simple 7 (AHA, 2017). Cardiovascular health is a continuum and is thus represented as being ideal, intermediate, or poor for each of the seven metrics. In addition to the traditional treatment of cardiovascular disease, this concept focuses on prevention and promotion (Benjamin et al., 2017).

1.1.1. Prevalence and mortality

From 2011-2014 in the United States, the total prevalence rate of cardiovascular diseases was 36.6% (37.4% for men and 35.9% for women), which is similar in both genders between 40 to 59 years of age (39.4% women and 41.4% men) but, at >80 years, women have a higher prevalence (86.5%) than men (84.4%) (Benjamin et al., 2017). In addition, heart disease prevalence is greater among those with lower education and who are unemployed (Benjamin et al., 2017). In Europe, age-standardized prevalence rates for cardiovascular disease were higher in men (7,147 per 100.000) than in women (5,612 per 100.000). In Spain, age-standardized prevalence rates were also higher in men (5,781 per 100.000) than in women (4,593 per 100.000) (Wilkins et al., 2017). To the date, there are no data on prevalence rates in cardiovascular diseases in Andalusia.

According to the WHO, cardiovascular diseases are the leading cause of death, accounting for more than 17 million deaths per year, representing 46.2% of non-communicable disease deaths (see, Figure 1) (Lozano et al., 2012; WHO, 2017b). Worldwide, cardiovascular diseases accounted for 24.4% of deaths among women and 33.5% for men (Roth et al., 2017).

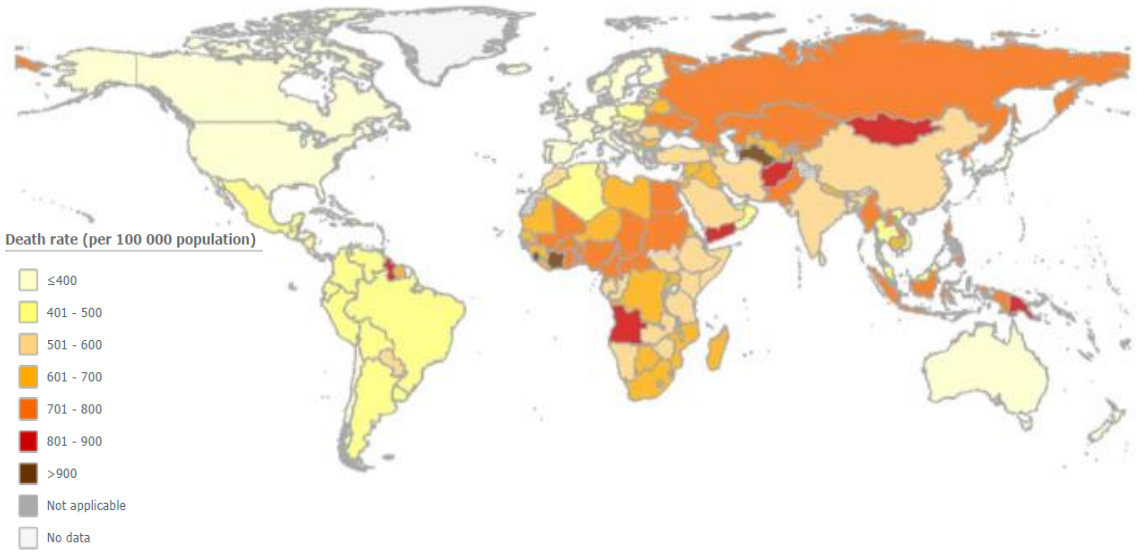

Figure 1. Global distribution of cardiovascular disease mortality rates in both genders (age standardized, per 100,000 persons). Retrieved from http://www.who.int/gho/ncd/en/

In Europe, mortality rates show wide geographic inequality with more than four million deaths each year due to CVD, accounting for 45% of all deaths (Townsend et al., 2016; Wilkins et al., 2017). Data from Europe shows that Denmark and Norway have the lowest rates of cardiovascular disease mortality, joining other countries such as Spain, Portugal, the Netherlands, and France (Nichols, Townsend, Scarborough, & Rayner, 2014). In Europe, estimated deaths from cardiovascular disease were higher among women (49%) than among men (40%) (Townsend et al., 2016; Wilkins et al., 2017) (see Figure 2).

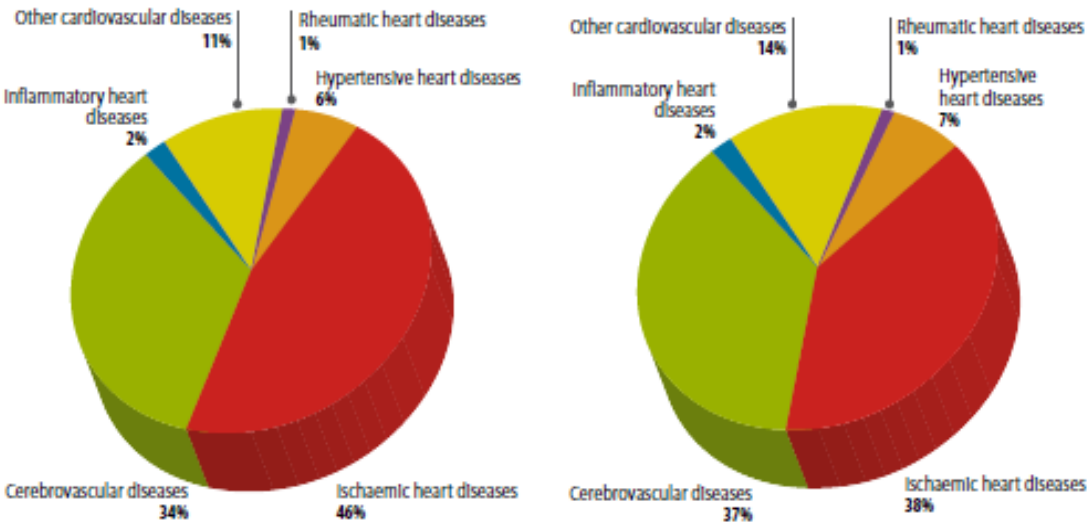

Figure 2. Proportion of deaths from cardiovascular diseases in males (left) and females (right). Reproduced from Mendis, S., Puska, P., & Norrving, B. (Eds). (2011). Global Atlas on Cardiovascular Disease Prevention and Control.

Despite prevalence is higher in men, in 2016 in Spain, cardiovascular diseases caused 29.17% of overall deaths (53.82% women) and in Andalusia represented 32.12% (54.33% women) (Inventario de operaciones estadísticas, 2017) (see Figure 3). Regarding the association between mortality and age, the proportion of deaths increased with age. Specifically, deaths before age 75 accounted for 35%, while deaths before age 65 accounted for 29% (Townsend et al., 2016). Mortality rates increase up to 71.43% in people over 80 years of age (45.09% for women and 26.32% for men) (Nichols et al., 2014). In addition, sociodemographic characteristics were associated with cardiovascular diseases mortality where countries with better sociodemographic characteristics showed a cardiovascular disease mortality reduction (Roth et al., 2017).

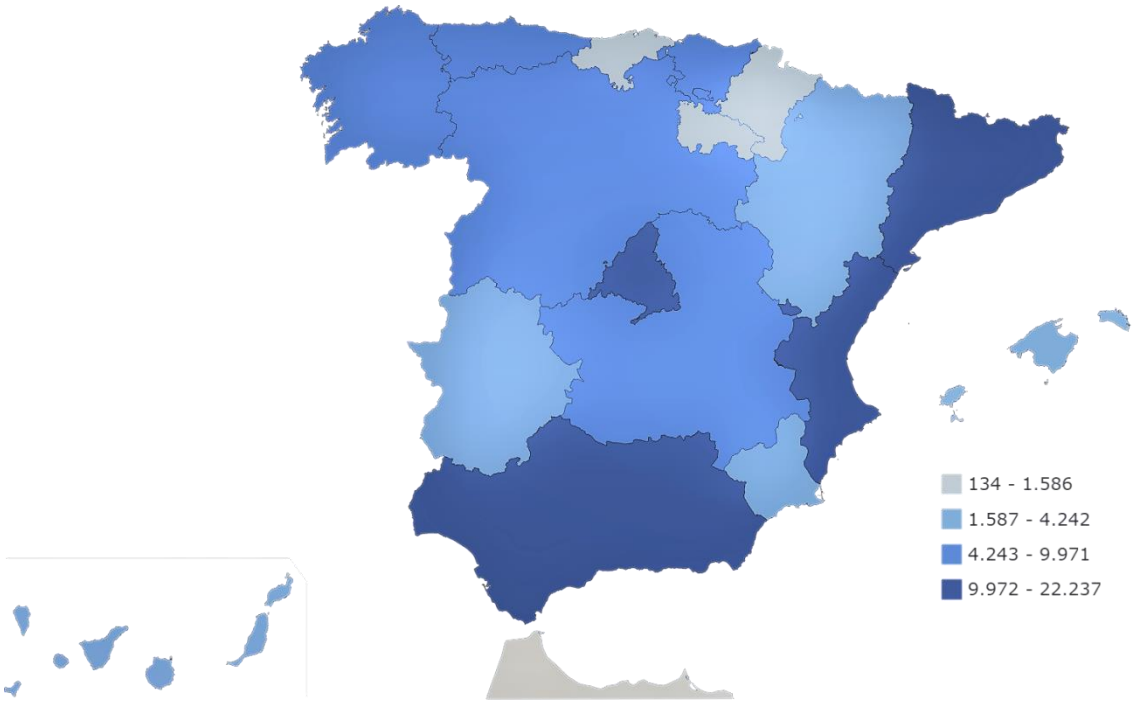

Figure 3. Overall deaths from cardiovascular diseases in Spain. Reproduced from Inventario de operaciones estadísticas, 2017.

Cardiovascular disease mortality has been declining. This decline first appeared during the late 1970s. Despite an increase in cardiovascular diseases burden, the adjusted mortality continues to decline, primarily as a result preventive interventions and rehabilitation (Allender, Scarborough, O'Flaherty, & Capewell, 2008; Gaziano, Bitton, Anand, Abrahams-Gessel, & Murphy, 2010). Due to the efforts of primary and secondary prevention and the management of risk factors, the rate of cardiovascular diseases mortality has declined in several countries including the United States, Australia, and most European countries including Spain (Australian Institute of Health and Welfare, 2017; Institute for Health Metrics and Evaluation, 2018; Nichols et al., 2014; Roth et al., 2017; Sidney et al., 2016). Moreover, the rate of hospitalizations due to cardiovascular diseases has increased in most countries (Nichols et al., 2014) and morbidity is rising, with increasing numbers of myocardial infarction survivors (Mathers, Fat, & Boerna, 2008).

Cardiovascular diseases are the leading causes of loss of Disability-Adjusted Life Years (DALY) globally, accounting for 10% of total DALYs in low- and middle-income countries and up to 18% in high-income countries (Mackay & Mensah, 2017). In Europe, cardiovascular diseases were the main cause of DALYs (24.1% men and 22.1% women). Specifically, in Spain, cardiovascular diseases accounted for 15.6% of DALYs (16.14% men and 13.93% women) (Institute for Health Metrics and Evaluation, 2018).

1.1.2. Risk factors for cardiovascular diseases

A risk factor is "any attribute, characteristic or exposure of an individual that increases the likelihood of developing a disease or injury" (WHO, 2017c). As noticed early in the 1960s, cardiovascular diseases are multifactorial diseases with several factors identified (Dawber & Kannel, 1966). These factors can be grouped into three categories: causal factors, conditional factors, and predisposing factors. Causal factors have predictive power in the development of a cardiovascular disease. These factors are cigarette smoking, elevated blood pressure, elevated cholesterol, diabetes mellitus, and age. Conditional factors are associated with an increased risk of cardiovascular disease such as elevated triglycerides or elevated homocysteine. Finally, predisposing factors are those that worsen the independent impact on cardiovascular disease and include family history of cardiovascular diseases, obesity, physical inactivity, ethnic characteristics, and psychosocial factors (Grundy, Pasternak, Greenland, Smith, & Fuster, 1999). Following the presence of several risk factors, the Framingham Heart Study introduced the concept of multivariable risk assessment for cardiovascular diseases (Mahmood, Levy, Vasan, & Wang, 2013). The management of risk factors such as elevated blood pressure, smoking, overweight,

diabetes, and elevated cholesterol reduces recurrent events and improves quality of life in patients with cardiovascular diseases.

Results from several projects and studies have highlighted the potential of cardiovascular disease prevention. One of the main findings of the MONICA project was that two thirds of the change in coronary mortality could be attributed to changes in risk factors (Tunstall-Pedoe et al., 1999). Specifically, more than the 50% of the cardiovascular disease mortality reduction is related to changes in risk factors (Perk et al., 2012). The INTERHEART study was a global case-control study that included 52 countries worldwide with the aim of assessing the effect of nine modifiable risk factors for myocardial infarction including smoking, hypertension, diabetes, waist-to-hip ratio, dietary pattern, physical activity, alcohol consumption, blood apolipoproteins, and psychosocial factors (Yusuf et al., 2004). These authors found that the modification of these nine risk factors might reduce the burden of coronary heart disease by 90%. In Europe, with the aim of evaluating guidelines on cardiovascular disease prevention, EUROASPIRE surveys were conducted in 1995-1996 assessing lifestyle, risk factors, and therapeutic management of coronary patients from 24 European countries (EUROASPIRE study group, 1997). These cross-sectional surveys found that the potential for secondary prevention of cardiovascular diseases is underused, with a large number of patients with inadequate risk factor control, not achieving guideline standards for secondary prevention (Kotseva et al., 2009; Kotseva et al., 2010; Kotseva et al., 2016).

The presence of risk factors such as diabetes, smoking, cholesterol, and blood pressure influence lifetime risk of developing a cardiovascular disease (Berry et al., 2012). In addition, within the five years following a myocardial infarction, there is a

high recurrence of a new myocardial infarction (15% in men and 22% in women) (Roger et al., 2011). Different studies such as EUROASPIRE IV, in which Spain is included, and PURE have demonstrated a high prevalence of undertreatment of risk factors in coronary patients in several regions of the world (Kotseva et al., 2016; Teo et al., 2013).

As mentioned above, to achieve effective prevention of cardiovascular diseases, cardiac guidelines highlighted the assessment of risk factors, enabling the adaptation of the prevention programs individually (Smith et al., 2011). Traditionally, the literature has focused on the following major risk factors:

1. Elevated blood pressure

   The prevalence of hypertension was estimated to be 34.0% (men 34.5%, women 33.4%), and is increased in those ≥60 years of age (67.2%) (Benjamin et al., 2017). However, the prevalence of high blood pressure is greater among women ≥65 years of age than among men, and is more than twice as high in postmenopausal women than in premenopausal women (Benjamin et al., 2017; Mosca, Barrett-Connor, & Wenger, 2011; Pimenta, 2012). A recent meta-analysis of 124 cohort studies comparing the gender-specific associations between systolic blood pressure and the risk of cardiovascular disease found a similar association between systolic blood pressure and the risk of CVD in women and men (Peters, Huxley, & Woodward, 2013).

2. Cigarette smoking

   Overall smoking rates have been declining over the past decade (WHO, 2017d). The global prevalence of smoking is higher in men than in women (48% vs 10%) (Hitchman & Fong, 2011). Notwithstanding, women have a

50% greater risk of coronary heart disease due to smoking compared with men (Huxley & Woodward, 2011). Authors found that the pooled adjusted female-to-male relative risk ratio of smoking compared with non-smoking for coronary heart disease was 1.25 (95% CI: 1.12-1.39; $p \leq 0.001$). Moreover, the risk of coronary heart disease in women increased by 2% for every additional year ($p=0.03$) (Huxley & Woodward, 2011).

3. Type 2 Diabetes Mellitus

   Low-income countries showed the lowest prevalence of type 2 diabetes mellitus (Mendis et al., 2011). Specifically, type 2 diabetes mellitus is a more powerful coronary heart disease risk factor in women than in men (Appelman, van Rijn, ten Haaf, Boersma, & Peters, 2015). In a meta-analysis, authors found that diabetes doubled the risk of coronary heart disease in men (RR: 2.13 [95% CI: 1.82-2.56]) and almost tripled the risk in women (RR: 2.82 [95% CI: 2.35-3.38]) (Huxley, Barzi, & Woodward, 2006). Regarding age, diabetes in women under the age of 60 is more strongly associated with MI than in those over the age of 60 (OR: 5.69 [95% CI: 4.36-7.42] vs OR: 3.71 [95% CI: 3.10-4.45]) (Anand et al., 2008).

4. Overweight and obesity

   Levels of obesity are usually higher in men in high-income countries, while the contrary is more common in low- and middle-income countries (Appelman et al., 2015). Higher body mass index values were associated with higher risk of cardiovascular disease (HR: 1.07 [95% CI: 1.03-1.11]) (Wormser et al., 2011), and with higher cardiac mortality among women (HR: 1.71 [95% CI: 1.63-1.80)] than in men (HR: 1.38 [95% CI: 1.33-1.44]) (Dudina et al., 2011).

5. Cholesterol

   Higher levels of high-density lipoprotein cholesterol are associated with lower risk of coronary heart disease mortality in men (21%) and women (26%) (Farzadfar et al., 2011). In women, raised cholesterol appears after the menopausal period and is higher than in men (Maas & Appelman, 2010).

As has been pointed out, there are gender differences in risk factors. Specific risk factors for cardiovascular disease in women will be addressed in the next section.

1.1.3. Risk factors for cardiovascular disease in women

In 1985, the first report specifically focused on women's health was published (Women's Health, 1985). In 1999, the AHA developed the first women-specific clinical recommendations for cardiovascular disease prevention (Mosca et al., 1999). Since the 1990s, several cardiovascular disease guidelines for women have been published (Mosca et al., 2007; Mosca, Benjamin et al., 2011; Mosca, Hammond, Mochari-Greenberger, Towfighi, & Albert, 2013; Raeisi-Giglou et al., 2017). These gender-specific statements provide opportunities to improve cardiovascular health care for women. As mentioned above, determinants for cardiovascular diseases are similar among men and women, but there are gender-specific implications (Engberding & Wenger, 2013; Mosca, Barrett-Connor et al., 2011). In a report on gender differences in risk factor distributions in the INTERHEART study, the authors found that hypertension, diabetes, and physical activity were more strongly associated with myocardial infarction in women compared to men (Anand et al., 2008). In addition, the progress of cardiovascular disease is different across genders. Women have a poorer cardiac risk profile compared to men (34.9% vs

29.5%, p<0.001). These differences between genders decrease in patients younger than 70 years of age (35.8% vs 31.6%, p=0.01) and those with higher educational levels (32.5% vs 29.8%, p=0.005) (de Smedt et al., 2016).

The scientific evidence has shown a specific cardiac profile exclusive to women such as being older and having more comorbidities than men (Mosca et al., 2000; Regitz-Zagrosek et al., 2016), adverse pregnancy outcomes, menopause, or higher prevalence of depression (García et al., 2016; Lichtman et al., 2014; Roger et al., 2011). The presence of risk factors, such as abnormal lipids, hypertension, type 2 diabetes mellitus, or smoking, in women before the age of 60 should be used as indicators of primary prevention for a cardiovascular disease (Anand et al., 2008). These gender differences may influence the management of the risk factors in women. The literature has focused on the following women-specific risk factors:

1. Age

   The mean age of onset of cardiovascular disease is almost ten years later in women than in men. This is related, at least, in part, to the decline in hormone concentrations during the menopausal period (Anand et al., 2008; Dallongeville et al., 2010; Mosca et al., 2000).

2. Preeclampsia

   Incidence rates of preeclampsia are between 3% and 10%, and are related to other predisposing disorders such as hypertension, diabetes, or obesity (Duley, 2009). A meta-analysis found that the relative risk of coronary heart disease in women with preeclampsia was almost twice as high as in women with a normotensive pregnancy (RR: 2.1 [95% CI: 1.86-2.52]) (Bellamy, Casas, Hingorani, & Williams, 2007).

3. Gestational diabetes mellitus

   The prevalence of gestational diabetes mellitus is between 3% and 5%. Gestational diabetes mellitus increases the risk of developing type 2 diabetes mellitus and hypertension. A recent systematic review found that the effect of gestational diabetes mellitus on the incidence of cardiovascular diseases independent of other risk factors remained inconclusive (Archambault, Arel, & Filion, 2014).

4. Menopause

   Two meta-analyses found that early menopause (<50 years) was an independent predictor of coronary heart disease (RR: 1.38 [95% CI: 1.15-1.35]) (Atsma, Bartelink, Grobbee, & van der Schouw, 2006), even after adjustment for traditional cardiovascular diseases risk factors (HR: 2.08 [95% CI: 1.17-3.70]) (Wellons, Ouyang, Schreiner, Herrington, & Vaidya, 2012). In addition, a recent meta-analysis found a higher risk of cardiovascular disease mortality in early menopausal women (RR: 1.19 [95% CI: 1.08-1.31]) (Muka et al., 2016).

5. Depressive symptoms

   Global depression prevalence is more common among women (5.1%) than among men (3.6%) (WHO, 2017e). Depression accounts for almost 30% of the attributable risk of myocardial infarction, and patients with depression have 2.2 increased mortality risk (Rosengren et al., 2004; Watkins et al., 2013). EUROASPIRE IV shows that the prevalence of depressive symptoms in women with cardiovascular disease is higher (30.6%) than in men (19.8%) (Pogosova et al., 2017). Depressive symptoms may affect cardiac outcomes due an increase in high-risk behaviors, such as smoking, sedentary lifestyle,

non-adherence to prevention measures, or delay in seeking treatments (Lichtman et al., 2014).

The lower rates of treatment to guidelines observed in women may be explained by sex-based differences in symptoms. Studies found that women report throat, back, jaw, and neck discomfort; recall more previous symptoms; experience chest pain that is less specific; and have more nausea, dyspnea and extreme fatigue (Mackay, Ratner, Johnson, Humphries, & Buller, 2011; Patel, Rosengren, & Ekman, 2004). In addition, women are usually less able to recognize and identify cardiovascular risk factors (Mosca et al., 2013). Nevertheless, it seems that the belief that the symptoms are cardiac in origin leads to seeking emergency and medical more quickly. Because women recall more symptoms it might make it difficult for them to accurately perceive these symptoms as a cardiac problem (Maas & Appelman, 2010; Patel et al., 2004).

In summary, although cardiovascular morbidity and mortality have been reduced it remains the first noncommunicable cause of death. Assessment and treatment of risk factors have been highlighted. In this context, preventive strategies are of the utmost importance.

1.2. Preventive strategies and cardiac rehabilitation

1.2.1. Preventive strategies

One of the current aims of the European Society of Cardiology, the AHA, and the American College of Cardiology Foundation, among other associations, is to improve the practice of preventive cardiology. Preventive strategies for cardiovascular diseases include prevention of clinical manifestations of cardiovascular diseases (primary prevention) and aggressive risk factor control which can have an impact on preventing recurrences of the disease (secondary prevention) (Wong, 2015).

In primary prevention context, several implementation and evaluation guidelines have been developed to improve the management of both risk factors and cardiovascular disease. According to the most recent National Institute for Health and Care Excellence (NICE) guideline for primary prevention in cardiovascular disease, identification of individuals with non-modifiable or modifiable risk factors should be undertaken through primary care (NICE, 2014). After identifying those people at high risk for cardiovascular disease, lifestyle changes or even lipid modification therapy strategies should be implemented. The OASIS randomized trial found that adherence to recommendations for diet, smoking, and exercise were associated with a lower rate of major cardiovascular events and all-cause mortality (OR: 0.30 [95% CI: 0.17-0.42]) (Chow et al., 2010).

In secondary prevention context, appear cardiac rehabilitation (CR) programs. These programs will be specifically addressed in next section.

1.2.2. Cardiac rehabilitation

The AHA defined CR as "coordinated, multifaceted interventions designed to optimize a cardiac patient's physical, psychological, and social functioning, in addition to stabilizing, slowing, or even reversing the progression of the underlying atherosclerotic processes, thereby reducing morbidity and mortality" (Leon et al., 2005, p. 369).

Following this definition, CR should be considered a multicomponent and multidisciplinary program with the aim of reducing modifiable risk factors (e.g., smoking, cholesterol levels, or hypertension) (Balady et al., 2007; Leon et al., 2005). The aim of CR is to reduce the cardiovascular profile risk, promote and maintain a healthy lifestyle, improve quality of life, and reduce disability (Balady et al., 2007). To address multicomponent objectives, a multidisciplinary health team is needed and should include a cardiologist, nurse, physiotherapist, psychologist, dietitian, and occupational therapist (British Association for Cardiovascular Prevention and Rehabilitation [BACPR], 2012).

International guidelines recommend CR as an effective and safe intervention (NICE, 2015), and CR has been proven to be a cost-effectiveness treatment (De Smedt et al., 2012). Following the AHA and the American College of Cardiology Foundation guidelines (see Figure 4), CR is considered an evidence Class I, Level A recommendation for those patients with myocardial infarction, coronary artery bypass graft surgery, percutaneous coronary interventions, and peripheral arterial disease. In those patients with chronic angina, CR is an evidence Class I, Level B recommendation. Finally, for those patients with a history of heart failure, CR is an evidence Class IIa, Level B recommendation.

Grade of recommendation	I Strong recommendation to do	IIa Moderate recommendation to do	IIb Weak recommendation to do	III Recommendation not to do
Conclusions of evidence	Benefits >>> risk & burdens	Benefits >> risk & burdens	Benefits >= risks & burdens	No benefit / Potentially harm
A High level of evidence Consistent evidence from well performed and high quality studies or systematic reviews (low risk of bias, direct, consistent, precise)	Strong recommendation based on high level of evidence	Moderate recommendation based on high level of evidence	Weak recommendation based on high level of evidence	Recommendation based on high level of evidence
B Moderate /Low level of evidence Evidence from studies or systematic reviews with few important limitations	Strong recommendation based on moderate/ low level of evidence	Moderate recommendation based on moderate/ low level of evidence	Weak recommendation based on moderate/ low level of evidence	Recommendation based on moderate/ low level of evidence
C Very low level of evidence Evidence from studies with serious flaws. Only expert opinion, or standards of care	Strong recommendation based on expert opinion	Moderate recommendation based on very low level of evidence Diverging expert opinions	Weak recommendation based on very low level of evidence Diverging expert opinions	Recommendation based on very low level of evidence Expert opinion

Figure 4. Classification of recommendation and level of evidence. Reproduced from Smith et al., (2011). AHA/ACCF Secondary Prevention: 2011 Update

Overall, CR is available in 38.8% countries worldwide (Turk-Adawi, Sarrafzadegan, & Grace, 2014) of which 68% are in Europe (Bjarnason-Wehrens et al., 2010; Vanhees, McGee, Dugmore, Schepers, & van Daele, 2002). In Spain, the incorporation of CR programs into the Spanish National Health Service has grown, but it is still low in comparison with the rest of Europe. To our knowledge, the last updated studies analyzing the status of CR programs in Spain are the ESRECA study and the R-EURECA registry (de Pablo, 2014; García-Hernández et al., 2014). Authors found that in 2014 there were between 76 and 114 active CR programs in Spain. Nonetheless, only 7% of patients with cardiovascular diseases were able to benefit from CR. Specifically in Andalusia, the most recent study published identified a total of 22 CR centers in 2015, with a total of 1764 patients attended in this region

(Fernández, Otero, Torres, & Gómez, 2017). However, the authors pointed that most CR centers were in urban areas, generating an access problem for those patients living in rural areas.

Regarding the duration, frequency, and length of the program, recent systematic reviews have found that there is no worldwide consensus on the number of sessions, which range from a minimum of three weeks (Germany) to a maximum of twelve months (Australia), with an average duration of 12 weeks (mean ± SD, 16.8 ±14.6), ranging from 4 to 52 weeks, with a median number of prescribed sessions per week of 2.5 (mean ± SD, 2.6 ±1.1) (Price, Gordon, Bird, & Benson, 2016; Santiago de Araújo Pío, Marzolini, Pakosh, & Grace, 2017). The duration of CR programs differs between countries and varies widely. For example, diverse guidelines provide recommendations for the number of sessions based on the cardiac risk level of the patients and their progress (American Association of Cardiovascular and Pulmonary Rehabilitation, 2013; McCreery et al., 2013; Price et al., 2016). In Spain, according to the recommendations proposed by the RECABASIC project, the number of recommended sessions, ranging from 12 to 36 total sessions, should be determined by the patient's risk stratification (García-Hernández et al., 2017). Similar to Spain overall, the number of sessions in Andalusia ranged from five to 36 total sessions (Fernández et al., 2017).

The core components of CR have been standardized. However, the structure differs widely by country because of national guidelines and different legislations (Bjarnason-Wehrens et al., 2010; Piepoli et al., 2014). Although CR has been defined by different international associations, there is still heterogeneity across CR programs in Spain. For this reason, the RECABASIC project proposed basic

standards that should be included in these programs (García-Hernández et al., 2017). Based on this project, the main objectives of CR in Spain are:

1. To achieve a healthy lifestyle with control of cardiac risk factors.
2. To achieve an optimal physical exercise level.
3. To provide education about cardiovascular disease and its treatment to patients and their families.
4. To provide psychological counseling to patients and their families.
5. To promote the return to work of patients after the cardiac event.

Hence, core components aim to optimize cardiovascular risk reduction and to adhere to lifestyle behavior changes, promoting an active lifestyle for patients with cardiovascular disease. The core components of CR programs include baseline assessment, nutritional counseling, risk factor management, psychosocial counseling, physical counseling, and exercise training.

1. Patient baseline assessment

   Patient baseline assessment includes an evaluation of the medical history, a physical examination, exercise testing, and a quality of life assessment. With this assessment, the patient will receive a care plan and can communicate with his/her primary healthcare provider.

2. Nutritional counseling

   The first step in nutritional counseling is to obtain information about eating habits and to evaluate target areas for nutrition intervention. These areas are related to weight, hypertension, diabetes, heart failure, and other comorbidities. Second, specific and individualized dietary modifications are

prescribed to the patient. Among these, psychoeducation and strategies to modify behavior are given to the patient and his/her family members.

3. Risk factor management

   This includes smoking cessation, lipid management, hypertension management, weight management, diabetes management, and psychosocial management. Evaluation of these risk factors is the first step to achieve optimal management and to identify patients who smoke and/or have diabetes. After this, education and counseling interventions are provided to aid in smoking cessation and to achieve individualized goals regarding each associated risk factor.

4. Psychosocial counseling

   The first objective is to identify psychological distress such as levels of depression, anxiety, anger or hostility, social isolation, sexual maladjustment, and substance abuse. Individual or group interventions provide education regarding stress management and lifestyle changes. Patients with clinically significant psychosocial stress should be referred to a mental health specialist.

5. Physical activity counseling

   Physical activity counseling aims to achieve exercise program goals according to individual needs, providing recommendations on how to incorporate and increase physical activity.

6. Exercise training

   The aim is to develop an individualized exercise prescription for aerobic and resistance training based on the risk stratification of each patient.

Evaluation, interventions, and expected outcomes in each core component are updated in secondary prevention guidelines (Balady et al., 2000; Balady et al., 2007; Smith et al., 2011; Piepoli et al., 2014). In addition, cardioprotective drugs and adherence to medication are included in the management of each specific core component detailed above. Key cardioprotective drugs include antiplatelet therapy, beta blockers, or anticoagulants (BACPR, 2012).

CR programs can be delivered in a variety of settings. The most traditional setting, at the hospital, is called center-based CR. Other delivery models are home-based CR programs, defined as "a structured program with clear objectives for the participants, including monitoring, follow-up visits, letters or telephone calls from staff or at least self-monitoring diaries" (Taylor et al., 2015, p. 6). A recent review comparing home-based and center-based CR programs found that both were equally effective and their healthcare costs were similar (Anderson & Taylor, 2014). Another alternative delivery model is telehealth, or internet-based, which provides information and risk factor management by telephone or via internet (Clark et al., 2015). A recent meta-analysis found that the delivery of the exercise component by telehealth was as effective as hospital-based CR (Rawstorn, Gant, Direito, Beckmann, & Maddison, 2016). In this line, a systematic review found that community-based CR programs and telehealth delivery showed similar outcomes compared to traditional hospital-based CR, but there was insufficient scientific evidence to support the effectiveness of internet-based delivery (Clark et al., 2015).

In summary, CR programs have been proved as a recommended intervention in secondary prevention of cardiovascular diseases. Including multidisciplinary

components, the main goals of CR are reducing morbidity and mortality, and improving quality of life of the participants.

1.3. Patient involvement into cardiac rehabilitation

Patient involvement into CR programs is a process composed of three phases: referral, attendance, and adherence (Gaalema, Cutler, Higgins, & Ades, 2015). Following the definition proposed by these authors, **referral** is the moment the healthcare professional refers the patient to CR; **attendance** is going to at least one session of CR; and **adherence** is the completion of the recommended CR (Gaalema et al., 2015) (see Table 1). However, in the literature, several concepts have been employed about diverse aspects of the patient involvement process, limiting the comparisons between studies (Balady et al., 2011; Dalal, Doherty, & Taylor, 2015; Suaya et al., 2007; Turk-Adawi & Grace, 2015). Based on the proposal made by Gaalema et al. (2015), non-adherence process can be divided into **nonparticipation** and **dropout,** defining nonparticipation as not going to any session of CR, and dropout defined as the abandonment of the program at any point (see Table 1).

Table 1.

Patient involvement and non-adherence process

Patient Involvement Process	Referral	Is the moment the healthcare professional refers the patient to CR
	Attendance	Is going to at least one session of CR
	Adherence	Is the completion of the recommended CR
Non-adherence Process	Nonparticipation	Refers to not going to any session of CR.
	Dropout	Defined as the abandonment of the CR program at any point.

A. Referral

As mentioned above, the first requirement for patient involvement in CR is being referred to a program. Several clinical practice guidelines recommend the referral of all cardiovascular patients after suffering a cardiac event (Mosca, Benjamin et al., 2011; Smith et al., 2011; Thomas et al., 2010). Although the mean referral rate has increased in the past decade from 34% to 43.4%, it still remains low, with referral rates ranging from 22.2% to 73.7% (Colella et al., 2015; Cortés & Arthur, 2006). Cortés and Arthur (2006) conducted a systematic review about sociodemographic factors, health status, and healthcare system-related factors predicting referral to CR programs. These authors found that referral was associated with being younger than 65 years, being an English speaker, being married, male patients, having an education beyond high school level, having medical coverage, and having fewer complications after the cardiovascular event. Another study found that high-risk patients were significantly less likely to receive CR referral (Motivala et al., 2011). A recent systematic review found that those patients who smoke are more likely to be referred to a CR program (Gaalema et al., 2015). Concerning gender, sex bias in referral has been observed over the past decade and across many countries (Cortés & Arthur, 2006). Women are less likely to be referred to CR than men (OR: 0.68 [95% CI: 0.62-0.74]) (Colella et al., 2015; Scott, Ben-Or, & Allen, 2002). In this line, EUROASPIRE IV found that fewer women are advised to follow rehabilitation than men (45.9% vs 952.2%, p=0.05) (De Smedt et al., 2016).

Regarding barriers reported by both patients and professionals affecting low referral rates, a meta-synthesis found that most of the patients were not referred to CR due to avoidable reasons (Clark, King-Shier, Duncan et al., 2012). Thus, there

were three main barriers that influenced referrals: professional barriers (e.g. referrals too slow, perception of low patient willingness or capacity, low professional knowledge about CR programs), system barriers (e.g. territorial services, low financial support), and patient barriers (limited information and encouragement regarding CR services) (Clark, King-Shier, Duncan et al., 2012).

This first step in the process of involvement into CR is relevant, among other reasons, due its association with health care costs. A recent study found that health care costs were lower in participants of CR and costs were higher in those patients who were referred yet never attended any sessions (Alter, Yu, Bajaj, & Oh, 2017).

B. Attendance

Participation, adherence, or enrollment have usually been employed in the attendance phase referring to going at least one session to CR (Gaalema et al., 2015).

Participation in CR programs has demonstrated reductions in mortality and hospitalizations. Heran et al. (2011) found that CR participation reduced all-cause mortality by 13% and all-cause hospitalizations by 31%. Regarding the dose of CR, there is wide variation. A recent meta-regression found that CR dose may affect patient morbidity and mortality, suggesting that at least 12 sessions should be prescribed in order to reduce all-cause mortality (Santiago de Araújo Pío et al., 2017). Another meta-analysis found a reduction in pooled cardiovascular mortality (10.4% to 7.6%) and hospital admissions (30.7% to 26.1%) when participating in CR programs compared to nonparticipation control subjects (Anderson et al., 2016). In this line, a recent study found that those patients who participated in ≥67% of the prescribed sessions experienced significantly lower all-cause mortality (HR: 0.32

[95% CI: 0.24-0.44]) and lower cardiovascular mortality (HR: 0.35 [95% CI: 0.21-0.58]) (Alter et al., 2017).

After the referral process, literature reports a problem in attendance to CR programs. A recent meta-analysis found that enrollment ranged from 36.7% to 84.6% (Oosenbrug et al., 2016), and other studies found participation rates ranging from 14% to 35% (Balady et al., 2011; Dalal et al., 2015; Suaya et al., 2007). Over the past two decades, several reviews and advisories from the AHA have focused on the factors associated with CR participation (Balady et al., 2011; Dalal et al., 2015; Jackson, Leclerc, Erskine, & Linden, 2005; Ruano-Ravina et al., 2016; Taylor, Wilson, & Sharp, 2011; Witt, Thomas, & Roger, 2005; Wyer, Joseph, & Earll, 2001). These studies identified several factors related to participation that can be grouped into patient-related factors, medical factors, and healthcare system factors. These studies found that, among others, women, older age, low socioeconomic status, low educational level, low self-efficacy, low social support, comorbidities, home-care responsibilities, work-related factors, distance to CR program, or low strength of endorsement of CR participation were factors associated with lower CR participation. Participation rates are also different depending on the cardiac diagnosis or the risk factors, with higher participation rates among patients with coronary artery bypass graft than among those who have had a myocardial infarction (OR: 3.55 [95% CI: 3.35-3.76]) (Suaya et al., 2007), and with lower participation rates among patients who are smokers (Gaalema et al., 2015). With respect to gender differences in enrollment, a meta-analysis found lower enrollment in women compared with men (OR: 0.64 [95% CI: 0.57-0.72]) (Samayoa et al., 2014).

Regarding barriers to CR attendance, two meta-syntheses found that patients' decisions are influenced by psychosocial barriers (e.g. low insight and beliefs about the cardiac event, negative opinions about the service), system barriers (e.g. physician communication or lack of recommendation, beliefs about the exercise component) and contextual barriers (e.g. long distances, lack of social and family support) (Clark, King-Shier, Thompson et al., 2012; Neubeck et al., 2012). Several reviews found barriers to participation faced specifically by women that were associated with the health provider, the health system, and the individual (McCarthy, Dickson, & Chyun, 2011; Scott et al., 2002).

C. Adherence

The last phase of patient involvement in CR is adherence to and completion of the program. In this phase, terms such as completion, noncompletion or dropout have been employed.

One narrative review found that rates of dropout from CR ranged from 12% to 56% (Turk-Adawi & Grace, 2015). Although dropout has been considered a problem of adherence to CR, literature is scarce in this area and some authors suggest the factors are similar between nonparticipation in and dropout from CR programs (Balady et al., 2011). In this line, recent systematic reviews have found that women (Ruano-Ravina et al., 2016; Scott et al., 2002; Supervía et al., 2017) and patients who smoke were more likely to dropout from CR programs (Gaalema et al., 2015). Supervía et al. (2017) found factors specifically affecting women that were associated with dropout and these included having multiple comorbidities, being younger than 55, obesity, having depressive and/or anxiety symptoms, and smoking and/or being physical inactive prior to the coronary event. A meta-synthesis found

that completion was explained by perceptions and the degree to which CR programs met patients' expectations (Clark et al., 2013).

Barriers to CR adherence or completion have been less studied. A meta-synthesis found that patients reported several barriers and facilitators that influenced CR completion (Clark et al., 2013). On the one hand, patients reported individual and contextual barriers such as negative views of the health system, reactions to their heart disease, gender roles, or lack of family support as obstacles to completion. On the other hand, perceived benefits of CR or social networks were reported as facilitators for CR completion. A recent qualitative study found that patients who did not complete CR reported having misconceptions about the suitability, the exercise component, and the purpose of the program (Herber, Smith, White, & Jones, 2017).

1.3.1. Treatment gap in cardiac rehabilitation

Despite the clinical recommendations mentioned previously, participation in CR ranged from 20% to 50% (Dalal et al., 2015; Suaya et al., 2007). In Europe, results from EUROASPIRE-III and EUROASPIRE IV show that less than one-half of the patients with cardiovascular disease have access to CR programs (Kotseva, Wood, De Backer, & De Bacquer, 2013; Kotseva et al., 2016). In addition, the aforementioned factors and barriers support the idea that a treatment gap exists in the secondary prevention of cardiovascular diseases and an inequity in access to CR services. To achieve improved patient involvement in CR programs, different authors have proposed several strategies. To improve the problem of lack of referrals, some authors have proposed automatic referral to CR programs (Ades et al., 2017; Grace et al., 2011; Samayoa et al., 2014; Supervía et al., 2017). Automatic referral is defined as "the implementation of standing referral orders to CR based on

eligible diagnoses supported by clinical guidelines" (Fischer, 2008, p. 475). Some authors have shown that an automatic CR referral process can increase enrollment rates up to 61% (Ades et al., 2017; Grace et al., 2011; Supervía et al., 2017) specifically for women (OR: 1.40 [95% CI: 1.02-1.91]) (Samayoa et al., 2014). Other authors have proposed different settings to improve completion. Home-based CR settings could increase levels of completion (RR: 1.04 [95% CI: 1.01-1.07]) (Taylor et al., 2015), and gender-tailored delivery of CR could increase attendance by women up to 90% (Beckie & Beckstead, 2010). However, as a recent review highlighted, there is no specific evidence of improved attendance and adherence in women.

Finally, as reviewed above, the literature has focused on factors or barriers associated with attendance. However, studies on the specific factors and barriers for nonparticipation in and/or dropout from CR programs are scarce. Moreover, previous reviews and studies have organized factors associated with non-adherence following diverse theoretical approaches, hampering an overall understanding and developments in this field (Balady et al., 2011; Clark, King-Shier, Duncan et al., 2012; Clark, King-Shier, Thompson et al., 2012; Dalal et al., 2015; Jackson et al., 2005; McCarthy et al., 2011; Ruano-Ravina et al., 2016; Scott et al., 2002; Supervía et al., 2017).

1.4. Research questions and objectives

To summarize, cardiovascular diseases are the leading cause of death worldwide among both sexes. Although prevalence rates are typically lower in women than in men, mortality rates tend to be higher in women. In addition, the literature has widely shown that more than the 50% of cardiovascular disease mortality is associated with modifications in risk factors. For these reasons, prevention of cardiovascular diseases is essential. Secondary preventive interventions include CR programs. Following international guidelines, CR programs are multidisciplinary and multifactorial interventions that aim to reduce morbidity and mortality as well as improve quality of life in patients with cardiovascular diseases. For more than two decades, several meta-analyses and reviews have shown that attendance and adherence to these programs reduces the morbidity and mortality associated with cardiac events.

Despite proven benefits of adherence to CR programs, non-adherence rates remain high, increasing mortality and readmissions of patients with cardiovascular disease. Although several studies have pointed factors associated with adherence, there are some gaps in the literature. First, no previous studies have specifically focused on nonparticipation in and/or dropout from CR. Second, although female gender has been mentioned in the literature as a risk factor for non-adherence to CR programs, previous studies have failed to address the barriers women face for both nonparticipation in and/or dropout from CR. Finally, in Spain, no previous studies have focused on the reasons for dropout from CR programs in women.

Thus, the following specific research questions will be addressed:

1. What are the factors associated with nonparticipation in and/or dropout from CR?
2. What are the barriers reported by women for nonparticipation in and/or dropout from CR?
3. What are the specific reasons for CR dropout from the perspective of women who dropped out of the program?

The general objective of this thesis is to provide insight into the problem of non-adherence to CR programs in women. Consequently, the specific objectives of this thesis are:

1. To synthesize the literature about the factors associated with nonparticipation in and/or dropout from CR.

As mentioned in Chapter 1, several factors have been associated with adherence. However, no previous studies have focused on the factors associated with both nonparticipation in and/or dropout from CR. For this purpose, a systematic review of prospective cohort studies was carried out.

2. To synthesize the literature about the barriers associated with nonparticipation in and/or dropout from CR in women.

Studies have shown that women have higher rates of non-adherence to CR. However, previous studies have failed to address the barriers faced by women for their nonparticipation in and/or dropout from CR. Accordingly, a systematic review of the studies was undertaken.

3. To explore cardiovascular professionals and women's perceptions of their reasons for dropout from these programs.

Women are usually underrepresented into CR programs. In order to explore women's perceptions of their reasons for dropout from CR programs a qualitative study was conducted.

To achieve objectives 1 and 2, systematic review methodology was undertaken. According to the Cochrane definition, a systematic review

> "Attempts to collate all empirical evidence that fits pre-specified eligibility criteria in order to answer a specific research question. It uses explicit, systematic methods that are selected with a view to minimizing bias, thus providing more reliable findings from which conclusions can be drawn and decisions made" (Antman, Lau, Kupelnick, Mosteller, & Chalmers, 1992; Oxman & Guyatt, 1993; in Higgins & Green, 2011 retrieved from http://handbook-5-1.cochrane.org/).

More precisely, a systematic review implies several steps. First, predefined eligibility criteria are needed for the inclusion of the studies. Second, a systematic search must be performed following a reproducible methodology that identifies all eligible studies. Third, after the inclusion of the studies, an assessment of the validity of the findings is conducted through the assessment of risk of bias in each study. Finally, a synthesis of the findings is presented (Higgins & Green, 2011).

To achieve objective 3, a qualitative study was carried out employing both semi-structured interviews and a focus group. To address subjective health needs, qualitative data is required. These qualitative data aim to provide a better understanding of how health problems impact patients' lives and what type of

support they might need. In this line, following the conceptual framework developed by NICE (Kelly et al., 2009), where the patients' lifeworld is at the center, research needs to be open to diverse research designs that encompass socioeconomic, cultural, historical, and interaction questions (Shaw, Larkin, & Flowers, 2014).

Chapter 2

Methods and Results

Article I

Resurrección, D.M., Moreno-Peral, P., Gómez-Herranz, M., Rubio-Valera, M., Pastor, L., Caldas de Almeida, J.M., & Motrico, E. (2018). Factors associated with nonparticipation in and dropout from cardiac rehabilitation programs: A systematic review of prospective cohort studies, *European Journal of Cardiovascular Nursing, 18,* 1-10. doi:10.1177/1474515118783157

The main objective of this article is to synthesize the literature about the factors associated with nonparticipation in and/or dropout from CR

Article II

Resurrección, D.M., Motrico, E., Rigabert, A., Rubio-Valera, M., Conejo-Cerón, S., Pastor, L., & Moreno-Peral, P. Barriers for nonparticipation in and dropout of women in cardiac rehabilitation programs: A systematic review. *Journal of Women's Health, 26*(8) 849-859. doi:10.1089/jwh.2016.6249.

Previous literature have not specifically address what barriers are faced by women for their nonparticipation in and/or dropout from CR. For this purpose, the main objective of this article is to synthesize the literature about the barriers associated with nonparticipation in and/or dropout from CR in women.

Article III

Resurrección, D.M., Motrico, E., Rubio-Valera, M., Mora-Pardo, J.A., & Moreno-Peral, P. (submitted). Reasons for dropout from cardiac rehabilitation programs in women: A qualitative study**.** *PlosOne.*

Results from article II highlighted that there were no specific qualitative studies focused on the reasons reported by women for dropout from CR. For this purpose, the main objective of this article is to explore women's perceptions of their reasons for dropout from these programs.

Chapter 3

General Discussion

The overall objective of this thesis was to provide insight into the problem of non-adherence to CR programs in women. To this end, three empirical studies were undertaken (**Chapter 2, articles I, II and III**). These studies illustrated associated factors and barriers reported on nonparticipation in and/or dropout from CR, first, from the point of view of the literature (**articles I and II**) and, second, from the point of view of women and cardiovascular professionals (**article III**).

To address the main objective of this thesis, it was first necessary to identify the factors associated specifically with non-adherence to CR programs. Thus, **Chapter 2, article I,** aimed to systematically review prospective cohort studies that evaluate factors associated with nonparticipation in and/or dropout from CR programs. To our knowledge, this was the first systematic review to provide a comprehensive overview of associated factors for both nonparticipation in and/or dropout from CR programs. Following a socioecological model, factors were grouped into intrapersonal factors, clinical factors, interpersonal factors, logistical factors, CR program factors, and health system factors. On the basis of this first study, **article II** sought to provide insight into women's barriers reported specifically for nonparticipation in and/or dropout from CR programs. Following the same socioecological model as in article I, women's barriers were grouped into intrapersonal barriers, interpersonal barriers, logistical barriers, CR program barriers, and health system barriers. To achieve a deeper knowledge concerning the low involvement of women in CR, **article III** aimed to explore the main reasons for their dropout from a qualitative perspective. As in the previous two studies, a socioecological model was followed. This approach enabled us to structure the women's reasons for dropout from CR programs into the following factors:

intrapersonal, interpersonal, logistical, CR program characteristics, and health system.

This thesis shows three key findings. First, the non-adherence phenomenon is complex with several interrelated factors and barriers. Second, the results from the three studies are embedded into the same socioecological model. Third, specific factors and barriers are identified in each level of the model. These three key findings promote practical implications across multiple levels in prevention and promotion health policies. These key findings will be discussed below.

The **first key finding** is the complexity of the non-adherence process. The results highlighted the importance of splitting the process into its phases, thus, nonparticipation in and dropout from CR programs. Specifically, factors and barriers are different in each phase of the process. Taking this into consideration, different practical implications could be implemented in each phase, promoting the adherence of the general population and, more specific, of the women.

The **second key finding** of the present thesis is that the results from the three studies are embedded into a socioecological model. Socioecological models have been widely proposed for health promotion and interventions (Bronfenbrenner, 1979; Dahlgren & Whitehead, 1991; Marks, Murray, Evans, & Vida-Estacio, 2011; McLeroy et al., 1988). Based on the previous literature on ecological models and perspectives, the results from the three studies supported the idea of a socioecological model for the explanation of patient involvement in CR programs (see Fig 5). Acting through five structures, this model includes both the individual and the environmental factors and barriers that may influence women's involvement in CR programs. Thus, it provided an overall understanding of the CR

non-adherence process. This socioecological model presents the characteristic that each level is equally important. The levels are interrelated and influence each other. Moreover, the employment of a socioecological model provides a framework for future studies concentrating on the phenomenon of patient involvement in CR programs.

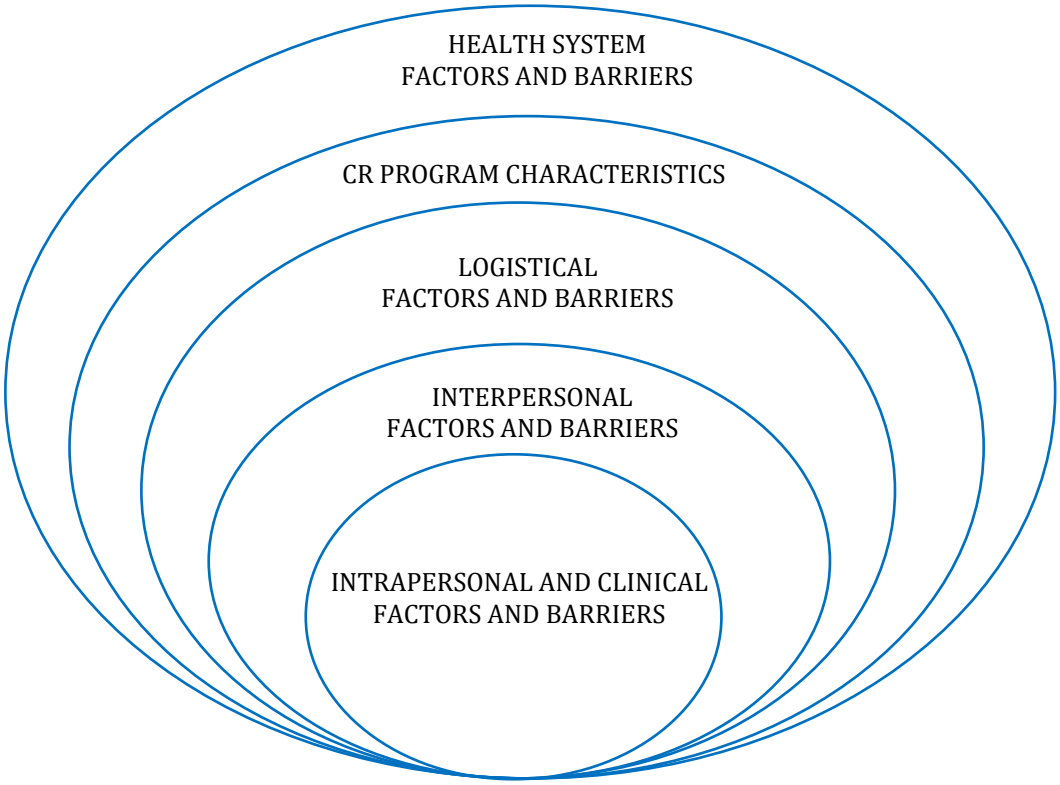

Figure 5. Socioecological model of factors and barriers to women's non-adherence to CR programs.

The **third key finding** is, based on the proposed socioecological model, factors and barriers are divided into five levels: intrapersonal and clinical; interpersonal; logistical; CR program characteristics; and health system.

Within the **intrapersonal and clinical level**, in article I, we found that being a woman was associated with nonparticipation in CR but not with dropout. Namely, gender was a controversial factor in its association with nonparticipation in and/or dropout from CR. In addition, the results revealed that a risk profile might exist in

cardiovascular patients comprising low socioeconomic and educational resources as well as low healthcare self-management. Following the cardiac risk factors presented in Chapter 1, patients with this profile might present related unhealthy lifestyle habits such as smoking, obesity, higher cholesterol levels, or type 2 diabetes mellitus. In addition to these results, in article II, women cited comorbidities and self-reported health problems as barriers for nonparticipation in and dropout from CR. Results from the three studies suggest that a women-specific cardiac risk profile might exist, influencing their non-adherence to CR programs. Specifically, women with a cardiac event tend to be older, with more comorbidities, mood or mental diseases, financial problems, and family and social commitments. These results are in agreement with the literature, which pointed out, that women with cardiovascular diseases tend to be older and present more comorbidities (Mosca et al., 2000; Regitz-Zagrosek et al., 2016). In line with these results, in article III we found that women reported depressive symptoms and lack of motivation as reasons for CR dropout. As will be addressed in practical implications (in Chapter 4), prevention programs should pay special attention to people with these risk profiles to promote healthier lifestyle habits to prevent nonparticipation and dropout from CR programs.

At the **interpersonal level**, in article I, we found that being single and having low social support was associated with nonparticipation in and dropout from CR. Specifically for women, in articles II and III, they reported not having family and social support. Interestingly, though, social support was widely reported as a barrier in women studies but appeared to a small extent in general population studies as an associated factor. In this line, in article I, only four studies employed a women-specific sample concealing some gender-specific factors. A plausible explanation

would be that women are at risk due to social isolation and may require greater social support to participate in and complete CR programs. It is noteworthy that, in article I, caregiver responsibilities did not appear as a factor associated with non-adherence. An explanation for this might be that caregivers are predominantly women. This need for social and family support is also related to the caregiver role reported by women as a barrier for nonparticipation in and dropout from CR.

Barriers at the **logistical level** have been widely reported in the literature as associated factors for non-adherence to CR. Nevertheless, we found that, except for being dependent for transport, logistical factors were associated with nonparticipation in but not with dropping out from CR in the general population. However, logistical barriers were reported by women in articles II and III. In article II, women reported transport problems and distance as barriers for dropping out from CR. In addition, the cost of CR and the cost of transport to CR were reported as barriers by women. In this line, in article III, women reported needing financial assistance for transport to access the program, and having to travel long distance to the CR. It is possible that women might face financial issues that also interact with logistical issues such as not being a driver or relying on other people that makes adherence to CR programs difficult. One possible explanation for the near absence of logistical factors associated with CR dropout might be that there are fewer studies focused on factors associated with dropout from CR programs than on nonparticipation.

With respect to **CR program level**, article I showed that only the previous participation in another CR program was a factor associated with nonparticipation, whereas several barriers were identified in articles II and III. Furthermore, barriers

related to the CR program characteristics were mainly reported for nonparticipation than for dropout. As health beliefs and perception about the disease and the treatment were identified for nonparticipation in CR, it is plausible that patients might have preconceived ideas about what CR is, the components of the programs, and what is expected from the participants. Regarding dropout, women reported in articles II and III that they dropped out from the program due to the timing. Usually, CR takes place in the mornings, conflicting with social and family demands. Future studies should address whether the possibility of choosing different time schedules could improve completion of CR programs.

The cardiovascular professionals in article III highlighted that women might not feel comfortable or dislike the exercise component, this result being in agreement with a previous qualitative study (Clark, King-Shier, Thompson et al., 2012). However, results from the semi-structured interviews of women in article III pointed to the possibility of two exercise profiles for women: lower- and higher-level exercise. Some women dropped out from the CR program because they expected more exercise activity. Other women felt pain during exercise. It is plausible that professionals have the perspective that all women are older, less functional, and suffer more pain or comorbidities than their male counterparts, resulting in a barrier for women to complete CR programs.

Finally, within the **health system level**, results from article I pointed that lack of referral was an associated factor for nonparticipation into CR programs. In women, results from article II highlighted that women faced lower rates of referral to CR. Lack of referral was widely reported by women and supports previous literature. Due to lower rates of referral to CR for women, it is essential to understand why

healthcare providers do not automatically refer women to CR programs. In consonance with previous literature, a possible explanation for lower referral rates in women could be that healthcare providers perceive women as older, with more comorbidities, a poorer cardiac diagnosis, financial problems, less interest in CR, other life priorities or inaccurate perceptions of their CR needs (Scott & Allen, 2004; Supervía et al., 2017). In this line, in article III, healthcare professionals emphasized that there is some disinformation about cardiovascular disease in women at the patient, social, family, and health system levels. This lack of awareness about the importance of prevention of cardiovascular diseases in women might be one of the causes of higher mortality rates among women than among men. Moreover, the belief that cardiovascular diseases have fewer consequences for women could be another reason for lower referral rates as has been reported in literature.

Strengths

The main strength in this thesis is the use of different methods to gain a deeper knowledge of the phenomenon of patient's involvement in CR. By doing this, we were able to integrate the clinical evidence from the systematic reviews, the views of patients and health professionals, and the qualitative study. As a strength of both systematic reviews presented in this manuscript (articles I and II), a total of 15.727 articles were retrieved, with a total sample of 68,042 patients in the 67 studies included, providing an updated overview of the scientific literature. A second strength is the division between nonparticipation in and/or dropout from CR programs contributing more comprehensive data on the adherence process. A third strength is that both systematic reviews followed the PRISMA statement (Moher, Liberati, Tetzlaff, & Altman, 2009). Consequently, the entire process was previously

registered in a protocol (see PROSPERO registration numbers in each article). These systematic reviews have updated previous reviews in the field. Likewise, regarding article III, the results were reported following the consolidated criteria for reporting qualitative research checklist (Tong, Sainsbury, & Craig, 2007). Accordingly, the study followed the quality criteria for this study design, enabling a better understanding of the process and the results.

Limitations

All research studies should be interpreted with caution due to diverse limitations, this thesis included. First, not all the studies included in the systematic review presented in **Chapter 2, article I**, provided adjusted results, and a certain degree of heterogeneity remained due to differences in CR components, sample sizes, follow-up periods, and the lower proportion of samples of women in comparison with samples of men.

The main limitation of the study presented in **article II** is that some of the articles reported barriers for nonparticipation in and/or dropout as secondary results. This led to the inclusion of diverse study designs. Hence, it was not possible to estimate the homogeneity in the barriers reported.

Finally, the main limitation in the qualitative study, **article III,** is that it was carried out in a Spanish region, which has specific health system policies and strong cultural components. For this reason, it is plausible that some health system barriers reported in the other studies did not appear in the qualitative analysis, such as the cost of the program. Despite this, the rest of the reasons for dropout from CR programs were similar to the barriers reported in **article II**, presuming equivalent results in other European countries.

Chapter 4

Conclusions

In line with the general aim of this thesis, we examined the factors and barriers related to women's non-adherence to CR programs. For this purpose, we carried out three studies. By identifying the factors and barriers associated with both nonparticipation in and/or dropout from CR, a more comprehensive understanding of the process of patient involvement in these programs was achieved. The primary outcomes of this investigation are the described below.

First, this thesis contributes more in-depth knowledge of the issues general population and, specifically women, face that result in their non-adherence to CR programs. By identifying factors and barriers reported by women, more accurate and multilevel health policies may be developed and implemented. In this line, Goal 3 of the Sustainable Development Goals adopted in 2015 by the United Nations (2018), strives to "ensure healthy lives and promote well-being for all at all ages". One of the targets is to reduce premature mortality from non-communicable diseases by one third by 2030. Cardiovascular disease is one of the four main types of non-communicable diseases that contribute to mortality. The report published in March of this year (UN, 2018) highlights the need to promote science and research and to implement a holistic approach to each health system strategy. In this sense, more women should be included in cardiovascular diseases and CR studies. Although some scientific progress has been made to improve adherence to CR, women are still underrepresented in these studies. As mentioned by Alosaimi, Reyes and Brown (2017), "there is no specific significant evidence of improvements in women's uptake and adherence".

Second, a contribution in a specific field of the non-adherence process has been made through the highlighting of the division between nonparticipation in and

dropout from CR. Since nonparticipation and dropout are two different phases along the non-adherence continuum, factors and barriers influence each one differently. Future studies could address non-adherence issues by providing results separately or by undertaking research with participants who did not participate or who dropped out.

Third, throughout the updating of the literature, the need for future studies explaining the interactions between several associated factors and gender is highlighted. Specific attention should be paid to women in the prevention of CVD and the promotion of their adherence to CR programs.

Taking together the previous literature and the results from this thesis, suggestions for **future research** are identified. Previous reviews have highlighted that women were at higher risk for nonparticipation (Jackson et al., 2005; Ruano-Ravina et al., 2016; Scott, Benn-Or, & Allen, 2002; Supervía et al., 2017). However, these reviews included diverse study designs and did not differentiate between nonparticipation in and dropout from CR, leading to potentially biased results. To test the association between gender and its specific relation to CR nonparticipation and/or dropout phenomena, future cohort studies that assess both outcomes separately are needed. In addition, there are several factors with scarce evidence or controversial associations with nonparticipation in and dropout from CR, such as age, gender, ethnicity, employment, practical support, illness beliefs, cardiac event, or CR program factors. To gain a deeper knowledge of the CR non-adherence process, further prospective cohort studies to evaluate the association of these controversial factors with nonparticipation in and/or dropout from CR are needed. Because adherence to CR is associated with several factors, future studies should focus on

assessing potential mediator or moderator variables between single factors such as gender, age, or socioeconomic status and their association with both nonparticipation in and/or dropout from CR. Moreover, future studies can also address different perspectives for a more thorough explanation of CR non-adherence. One of the future lines could provide a standard framework for the representation of the probabilities of various levels of non-adherence through a Bayesian network. Another future line could focus on the assessment of different ethnicities and their involvement in CR programs. Other qualitative studies could explore reasons for nonparticipation in CR in women. With the future aim of creating a general framework to explain patient involvement in CR, systematic reviews and qualitative studies to explore factors and reasons reported by men are also needed.

With respect to **practical implications** resulting from this thesis, it might prove useful to clinicians and policymakers in order to develop specific evidence-based interventions. These findings argue in favor of developing multifactorial health policies, to improve participation from different levels such as patient, social, and health system levels. Following the proposal of Green and Britten (1998), medical interventions need to be integrated within the social life and perspectives of the patient. In this sense, the combination of two systematic reviews and a qualitative study in this thesis provided greater insight into CR interventions. Thus, following the socioecological model, several practical implications are proposed:

- Intrapersonal level
    - Educate patients about their cardiac risk factor profile, benefits of adopting a healthy lifestyle, and benefits of CR participation.

- Interpersonal level
    - Improve peer and family support. Community services and social support may enhance participation in CR programs.
- Logistical level
    - Access to a shuttle service to and from the program. For those patients with low socioenomic status or non-drivers, access to a free transport service should be provided.
- CR program level
    - Adapt and improve CR program information. After suffering a cardiac event, patients may present illness and treatment beliefs that can interact negatively with the importance and objectives of CR programs.
    - Provide psychological screening and counseling. Treating low motivation, emotional distress, or inaccurate health beliefs prior to starting a CR program would encourage patients to participate and prevent early dropout.
    - Offer varied time schedules for CR programs. Modular CR components should also be offered. Women reported that programs scheduled in the mornings are inconvenient. Offering diverse schedules might promote completion of the programs.
    - Assess the specific needs of patients to offer more adaptive programs and provide post-discharge health support.
- Health system level
    - Educate cardiovascular professionals and providers about eligibility, CR components, and the benefits of the programs. Special attention

should be paid to patients with the risk profiles detailed in previous chapters, with the objective of promoting adherence to CR.

- Implement and develop health policies for automatic referral. Referral should be implemented as a performance measure of health quality after a cardiac event, following the indications reported by different international guidelines.
- Offer community- and home-based CR programs. For women with logistical or financial problems, offering a program closer to their residence might promote CR participation and completion.

References

Ades, P.A., Keteyian, S.J., Wright, J.S., Hamm, L.F., Lui, K., Newlin, K., …, Thomas, RJ. (2017). Increasing cardiac rehabilitation participation from 20% to 70%: A road map from the Million Hearts Cardiac Rehabilitation Collaborative. *Mayo Clinic, 92*(2), 234-242. doi:10.1016/j.mayocp.2016.10.014.

Allender, S., Scarborough, P., O'Flaherty, M., & Capewell, S. (2008). Patterns of coronary heart disease mortality over the 20th century in England and Wales: Possible plateaus in the rate of decline. *BMC Public Health, 8,* 148. doi:10.1186/1471-2458-8-148

Alter, D.A., Yu, B., Bajaj, R.R., & Oh, P.I. (2017). Relationship between cardiac rehabilitation participation and health service expenditures within a Universal Health Care System. *Mayo Clinical Proceedings, 92*(4), 500-511. doi: 10.1016/j.mayocp.2016.12.024

Alosaimi, O., Reyes, A.N., & Brown, C.A. (2017). Review of best practice in cardiac rehabilitation for women. *Internet Journal of Allied Health Sciences and Practice, 15*(3), article 8.

American Association of Cardiovascular and Pulmonary Rehabilitation (2013). *Guidelines for Cardiac Rehabilitation and Secondary Prevention Programs, sixth edition*. Champaign: Human Kinetics.

American Heart Association. (2017). http://www.mylifecheck.heart.org Accessed October 24, 2017

Anand, S.S., Islam, S., Rosengren, A., Franzosi, M.G., Steyn, K., Yusufali, A.H., … Yusuf, S. on behalf of the INTERHEART Investigators (2008). Risk factors for

myocardial infarction in women and men: insights from the INTERHEART study. *European Heart Journal, 29*, 932-940. doi:10.1093/eurheartj/ehn074

Anderson, L., Oldridge, N., Thompson, D.R., Zwisler, A., Rees, K., Martin, N., & Taylor, R.S. (2016). Exercise-based cardiac rehabilitation for coronary heart disease. Cochrane Systematic Review and Meta-analysis. *Journal of the American College of Cardiology, 67*(1), 1-12. doi:10.1016/j.jacc.2015.10.044

Anderson, L., & Taylor, R.S. (2014). Cardiac rehabilitation for people with heart disease: an overview of Cochrane systematic reviews. *The Cochrane Database of Systematic Reviews, 12*(12), CD011273. doi:10.1002/14651858.CD011273.pub2

Antman, E.M., Lau, J., Kupelnick, B., Mosteller, F., & Chalmers, T.C. (1992). A comparison of results of meta-analyses of randomized control trials and recommendations of clinical experts: Treatments for myocardial infarction. JAMA; 268: 240-248.

Appelman, Y., van Rijn, B.B., ten Haaf, M.E., Boersma, E., & Peters, S.A.E. (2015). Sex differences in cardiovascular risk factors and disease prevention. *Atherosclerosis, 241*(1), 211-218. doi:10.1016/j.atherosclerosis.2015.01.027

Archambault, C., Arel, R., & Filion, K.B. (2014). Gestational diabetes and risk of cardiovascular disease: A scoping review. *Open Medicine, 8*(1), e1-e9.

Atsma, F., Bartelink, M.E.L., Grobbee, D.E., & van der Schouw, Y.T. (2006). Postmenopausal status and early menopause as independent risk factors for cardiovascular disease: A meta-analysis. *Menopause: The Journal of The North American Menopause Society, 13*(2), 265-279. doi: 10.1097/01.gme.0000218683.97338.ea

Australian Institute of Health and Welfare. (2017). http://apo.org.au/node/107841 Accessed on October 24, 2017

Balady, G.J., Ades, P.A., Bittner, V.A., Franklin, B.A., Gordon, N.F., Thomas, R.J., … Yancy, C.W. (2011). Referral, Enrollment, and Delivery of Cardiac Rehabilitation/Secondary Prevention Programs at Clinical Centers and Beyond. A Presidential Advisory From the American Heart Association. *Circulation, 124*(25), 2951-2960. doi:10.1161/CIR.0b013e31823b21e2

Balady, G.J., Ades, PA., Comoss, P., Limacher, M., Pina, I.L., Southard, D., … Bazzarre, T. (2000). Core components of cardiac rehabilitation/secondary prevention programs: A statement for healthcare professionals from the American Heart Association and the American Association of Cardiovascular and Pulmonary Rehabilitation Writing Group. *Circulation, 102*(9), 1069-1073. doi.org/10.1161/01.CIR.102.9.1069

Balady, G.J., Williams, M.A., Ades, P.A., Bittner, V., Comoss, P., Foody, J.M., … Southard, D. (2007). Core Components of Cardiac rehabilitation/Secondary prevention programs: 2007 Update: A scientific statement from the American Heart Association Exercise, Cardiac Rehabilitation, and Prevention Committee, the Council on Clinical Cardiology; the Councils on Cardiovascular Nursing, Epidemiology and Prevention, and Nutrition, Physical Activity, and Metabolism; and the American Association of Cardiovascular and Pulmonary Rehabilitation. *Circulation, 115*(20), 2675-2682. doi:10.1161/CIRCULATIONAHA.106.180945

Beckie, T.M. & Beckstead, J.W. (2010). Predicting cardiac rehabilitation attendance in a gender-tailored randomized clinical trial. *Journal of Cardiopulmonary Rehabilitation and Prevention, 30*(3), 147-156. doi:10.1097/HCR.0b013e3181d0c2ce.

Bellamy, L., Casas, J.P., Hingorani, A.D., & Williams, D.J. (2007). Pre-eclampsia and risk of cardiovascular disease and cancer in later life: Systematic review and meta-analysis. *BMJ, 335*(7627), 974. doi:10.1136/bmj.39335.385301.BE

Benjamin, E.J., Blaha, M.J., Chiuve, S.E., Cushman, M., Das, S.R., Deo, R., … Muntner, P. (2017). Heart disease and stroke statistics – 2017 Update. A report from the American Heart Association. *Circulation, 136*(23), e1-e458. doi:10.1161/CIR.0000000000000485

Berry, J.D., Dyer, A., Cai, X., Garside, D.B., Ning, H., Thomas, A., … Lloyd-Jones, D.M. (2012). Lifetime risks of cardiovascular disease. *The New England Journal of Medicine, 366*(4), 321-329. doi: 10.1056/NEJMoa1012848.

Bjarnason-Wehrens, B., McGee, H., Zwisler, A.D., Piepoli, M.F., Benzer, W., Schmid, J.P., … Mendes, M. (2010). Cardiac rehabilitation in Europe: Results form the European Cardiac Rehabilitation Inventory Survey. *European Journal of Cardiovascular Prevention and Rehabilitation, 17*(4), 410-418. doi:10.1097/HJR.0b013e328334f42d.

British Association for Cardiovascular Prevention and Rehabilitation. (2012). *BACPR standards and core components for cardiovascular disease prevention and rehabilitation,* 2nd ed. UKBACPR. Retrieved from: www.bacpr.com/resources/46C_BACPR_Standards_and_Core_Components_2012.pdf

Bronfenbrenner, U. (1979). *The Ecology of Human Development: Experiments by Nature and Design*. Cambridge: Harvard University Press.

Chow, C.K., Jolly, S., Rao-Melacini, P., Fox, K.A.A., Anand, S.S., & Yusuf, S. (2010). Association of Diet, Exercise, and Smoking Modification With Risk of Early Cardiovascular Events After Acute Coronary Syndromes. *Circulation, 121*(6), 750-758. doi:10.1161/CIRCULATIONAHA.109.891523

Clark, A.M., King-Shier, K.M., Duncan, A., Spaling, M., Stone, J.A., Jaglal, S., & Angus, J. (2012). Factors influencing referral to cardiac rehabilitation programs: A systematic review. *European Journal of Preventive Cardiology, 20*(4), 692-700. doi:10.1177/2047487312447846

Clark, A.M., King-Shier, K.M., Spaling, M., Duncan, A., Stone, J.A., Jaglal, S., … Angus, J. (2013). Factors influencing participation in cardiac rehabilitation programmes after referral and initial attendance: Qualitative systematic review and meta-synthesis. *Clinical Rehabilitation, 27*(10), 948-959. doi:10.1177/0269215513481046

Clark, A.M., King-Shier, K.M., Thompson, D.R., Spaling, M., Duncan, A., Stone, J.A., … Angus, J. (2012). A qualitative systematic review on influences on attendance at cardiac rehabilitation programs after referral. *American Heart Journal, 164*(6), 835-845. doi: 10.1016/j.ahj.2012.08.020

Clark, R.A., Conway, A., Poulsen, V., Keech, W., Tirimacco, R., & Tideman, P. (2015). Alternative models of cardiac rehabilitation: A systematic review. *European Journal of Preventive Cardiology, 22*(1), 35-74. doi:10.1177/2047487313501093

Colella, T.J.F., Gravely, S., Marzolini, S., Grace, S.L., Francis, J.A., Oh, P., & Scott, L.B. (2015). Sex bias in referral of women to outpatient cardiac rehabilitation? A

meta-analysis. *European Journal of Preventive Cardiology, 22*(4), 423-441. doi: 10.1177/2047487314520783

Cortés, O., & Arthur, H.M. (2006). Determinants of referral to cardiac rehabilitation programs in patients with coronary artery disease: A systematic review. *American Heart Journal, 151*(2), 249-256. doi:10.1016/j.ahj.2005.03.034

Dahlgren, G., & Whitehead, M. (1991). *Policies and strategies to promote equity and health.* Stockholm: Institute for Future Studies.

Dalal, H.M., Doherty, P., & Taylor, R.S. (2015). Cardiac rehabilitation. A clinical review. *BMJ, 351,* h5000 doi: 10.1136/bmj.h5000

Dallongeville, J., De Bacquer, D., Heidrich, J., De Backer, G., Prugger, C., Kotseva, K., … Amouyel, P., on behalf of the EUROASPIRE Study Group. (2010). Gender differences in the implementation of cardiovascular prevention measures after an acute coronary event. *Heart, 96*(21), 1744-1749. doi:10.1136/hrt.2010.196170

Dawber, T.R., & Kannel, W.B. (1966). The Framingham Study. An epidemiological approach to coronary heart disease. *Circulation, 34,* 553-555. doi:10.1161/01.CIR.34.4.553

De Pablo, C. (2014, November). *Situación actual de la Rehabilitación Cardíaca en España: Registro R-EUReCa*. Conference presented at Congreso de las Enfermedades Cardiovasculares – SEC 2014, Santiago de Compostela, Spain. Retrieved from https://secardiologia.es/sec14

De Smedt, D., De Bacquer, D., De Sutter, J., Dallongeville, J., Gevaert, S., De Backer G., … Clays, E. (2016). The gender gap in risk factor control: Effects of age and education on the control of cardiovascular risk factors in male and female coronary patients. The EUROASPIRE IV study by the European Society of

Cardiology. *International Journal of Cardiology, 209*(15), 284-290. doi:10.1016/j.ijcard.2016.02.015

De Smedt, D., Kotseva, K., De Bacquer, D., Wood, D., De Backer, G., Dallongeville, J., … Annemans, L. (2012). Cost-effectiveness of optimizing prevention in patients with coronary heart disease: The EUROASPIRE III health economics project. *European Heart Journal, 33*(22), 2865–2872. doi: 10.1093/eurheartj/ehs210

Dudina, A., Cooney, M.T., De Bacquer, D., De Backer, G., Ducimetière, P., Jousilahti, P., … Graham, I., on behalf of the SCORe investigators. (2011). Relationships between body mass index, cardiovascular mortality, and risk factors: A report from the SCORE investigators. *European Journal of Cardiovascular Prevention and Rehabilitation, 18*(5), 731-742. doi:10.1177/1741826711412039

Duley, L. (2009). The global impact of pre-eclampsia and eclampsia. *Seminars in Perinatology, 33*(3), 130-137. doi: 10.1053/j.semperi.2009.02.010.

Engberding, N., & Wenger, N.K. (2013). Cardiac Rehabilitation for Women. *Current Cardiovascular Risk Reports, 7*(3), 203–211. doi:10.1007/s12170-013-0306-0

EUROASPIRE Study Group. (1997). EUROASPIRE. A European Society of Cardiology survey of secondary prevention of coronary heart disease: Principal results. *European Heart Journal, 18*(10), 1569-1582.

Farzadfar, F., Finucane, M.M., Danaei, G., Pelizzari, P.M., Cowan, M.J., Paciorek, C.J., … Ezzati, M. (2011). National, regional, and global trends in serum total colesterol since 1980: Systematic analysis of health examination surveys and epidemiological studies with 321 country-years and 3.0 million participants. *Lancet, 377*(9765), 578-586. doi:10.1016/S0140-6736(10)62038-7.

Fernández, M.R., Otero, E., Torres, J., & Gómez, J.J. (2017). Situación actual de las Unidades de Rehabilitación Cardíaca en Andalucía: Estudio EnANPREC. *Cardiocore, 52*(2), 66-74. doi:10.1016/j.carcor.2016.08.004

Fischer, J.P. (2008). Automatic referral to cardiac rehabilitation. *Journal of cardiovascular nursing, 23*(6), 474-479. doi:10.1097/01.JCN.0000338934.63661.c5.

Gaalema, D.E., Cutler, A.Y., Higgins, S.T., & Ades, P.A. (2015). Smoking and cardiac rehabilitation participation: Associations with referral, attendance and adherence. *Preventive Medicine, 80*(1), 67-74. doi:10.1016/j.ypmed.2015.04.009.

García, M., Miller, V.M., Gulati, M., Hayes, S.N., Manson, J.E., Wenger, N.K., … Mulvagh, S.L. (2016). Focused cardiovascular care for women: The need and role in clinical practice. *Mayo Clinical Proceedings, 91*(2), 226-240. doi: 10.1016/j.mayocp.2015.11.001

García-Hernández, P., Álvarez, M.I., Martínez-Castellanos, T., Portuondo, M.T., Ramón, M., Santillán, A., & Uría, I. (2014). Estudio ESRECA. Situación actual de los programas de prevención y rehabilitación cardíaca en España. *Enfermería en Cardiología, 62*, 52-61.

García-Hernández, P., Martínez-Castellanos, T. Mora-Pardo, J.A., Portuondo, M.T., Ramón, M., & Santillán, A. (2017). *Proyecto RECABASIC. Posicionamiento sobre los estándares básicos en recursos humanos, perfil y competencias profesionales, materiales, actividades y categorización de los Programas de Prevención y Rehabilitación Cardíaca en España.* Retrieved from:

http://prevencion.enfermeriaencardiologia.com/wp-content/uploads/proyecto-recabasic.pdf

Gaziano, T.A., Bitton, A., Anand, S., Abrahams-Gessel, S., & Murphy, A. (2010). Growing epidemic of coronary heart disease in low- and middle-income countries. *Current Problems in Cardiology, 35*(2), 72–115. doi: 10.1016/j.cpcardiol.2009.10.002.

Grace, S.L., Russell, K.L., Reid, R.D., Oh, P., Anand, S., Rush, J., … Stewart, D.E. (2011). Effect of cardiac rehabilitation referral strategies on utilization rates: A prospective, controlled study. *Archives of Internal Medicine, 171*(3), 235-241. doi:10.1001/archinternmed.2010.501.

Green, J., & Britten, N. (1998). Qualitative research and evidence based medicine. *BMJ, 316*(7139), 1230-1232.

Grundy, S.M., Pasternak, R., Greenland, P., Smith, S., & Fuster, V. (1999). Assessment of cardiovascular risk by use of Multiple-Risk-Factor Assessment Equations. A Statement for healthcare professionals from the American Heart Association and the American College of Cardiology. *Circulation, 100*(13), 181-1492. doi: 10.1161/01.CIR.100.13.1481

Heran, B.S., Chen, J.M.H., Ebrahim, S., Moxham, T., Oldridge, N., Rees, K., … Taylor, R.S. (2011). Exercise-based cardiac rehabilitation for coronary heart disease. *The Cochrane Database of Systematic Reviews, 6*(7), CD001800. doi:10.1002/14651858.CD001800.pub2.

Herber, O.R., Smith, K., White, M., & Jones, M.C. (2017). 'Just not for me' – contributing factors to nonattendance/noncompletion at phase III cardiac rehabilitation

in acute coronary syndrome patients: A qualitative enquiry. *Journal of Clinical Nursing, 26*(21), 3529-3542. doi: 10.1111/jocn.13722

Higgins, J.P.T., & Green S. (Eds.) (2011). *Cochrane Handbook for Systematic Reviews of Interventions. Version 5.1.0*. Available from http://handbook-5-1.cochrane.org/

Hitchman, S.C., & Fong, G.T. (2011). Gender empowerment and female-to-male smoking prevalence ratios. *Bulletin World Health Organization, 89*(3) 195-202. doi:10.2471/BLT.10.079905

Huxley, R.R., Barzi, F., & Woodward, M. (2006). Excess risk of fatal coronary heart disease associated with diabetes in men and women: meta-analysis of 37 prospective cohort studies. *BMJ, 332*(7533), 73-78. doi:10.1136/bmj.38678.389583.7C

Huxley, R.R., & Woodward, M. (2011). Cigarette smoking as a risk factor for coronary heart disease in women compared with men: A systematic review and meta-analysis of prospective cohort studies. *Lancet, 378*(9799), 1297-1305. doi:10.1016/S0140-6736(11)60781-2

Institute for Health Metrics and Evaluation. (2018). The Global Burden of Disease: generating evidence, guiding policy. http://www.healthdata.org/ Accesed February 12, 2018.

Inventario de Operaciones Estadísticas. (2017). http://www.ine.es/jaxiT3/Datos.htm?t=7947 Accesed June 8, 2017.

Jackson, L., Leclerc, J., Erskine, Y., & Linden, W. (2005). Getting the most out of cardiac rehabilitation: A review of referral and adherence predictors. *Heart, 91*(1), 10–14. doi:10.1136/hrt.2004.045559

Kelly, M.P., Stewart, E., Morgan, A., Killoran, M., Fischer, A., Threlfall, A., & Bonnefoy, J. (2009). A conceptual framework for public health: NICE's emerging approach. *Public Health, 123*(1), e14-e20. doi:10.1016/j.puhe.2008.10.031

Kotseva, K., Wood, D., De Backer, G., & De Bacquer, D. (2013). Use and effects of cardiac rehabilitation in patients with coronary heart disease: Results from the EUROASPIRE III survey. *European Journal of Preventive Cardiology, 20*(5), 817-826. doi:10.1177/2047487312449591

Kotseva, K., Wood, D., De Backer, G., De Bacquer, D., Pyörälä, K., & Keil, U., on behalf of the EUROASPIRE Study Group. (2009). EUROASPIRE III: A survey on the lifestyle, risk factors and use of cardioprotective drug therapies in coronary patients from 22 European countries. *European Journal of Cardiovascular Prevention and Rehabilitation, 16*(2), 121-137. doi: 10.1097/HJR.0b013e3283294b1d

Kotseva, K., Wood, D., De Backer, G., De Bacquer, D., Pyörälä, K., & Keil, U., on behalf of the EUROASPIRE Study Group. (2010). EUROASPIRE III. Management of cardiovascular risk factors in -asymptomatic high-risk patients in general practice: Cross-sectional survey in 12 European countries. *European Journal of Cardiovascular Prevention and Rehabilitation, 17*(5), 530-540. doi: 10.1097/HJR.0b013e3283383f30.

Kotseva, K., Wood, D., De Bacquer, D., Rydén, L., Jennings, C., Gyberg, V., … Vulic, D. (2016). EUROASPIRE IV: A European Society of Cardiology survey on the lifestyle, risk factor and therapeutic management of coronary patients from 24 European countries. *European Journal of Preventive Cardiology, 23*(6), 636-648. doi:10.1177/2047487315569401

Leon, A.S., Franklin, B.A., Costa, F., Balady, G.J., Berra, K.A., Stewart, K.J., … Lauer, M.S. (2005). Cardiac rehabilitation and secondary prevention of coronary heart disease. An American Heart Association scientific statement from the council on clinical cardiology (Subcommittee on Exercise, Cardiac Rehabilitation, and Prevention) and the Council on Nutrition, Physical Activity, and Metabolism (Subcommittee on Physical Activity), in collaboration with the American Association of Cardiovascular and Pulmonary Rehabilitation. *Circulation*, *111*(3), 369-376. doi:10.1161/01.CIR.0000151788.08740.5C

Lichtman, J.H., Froelicher, E.S., Blumenthal, J.A., Carney, R.M., Doering, L.V., Frasure-Smith, N., … Wulsin, L. (2014). Depression as a risk factor for poor prognosis among patients with acute coronary syndrome: Systematic review and recommendations. A Scientific Statement From the American Heart Association. *Circulation, 129,* 1350-1369. doi:10.1161/CIR.0000000000000019

Lloyd-Jones, D.M., Hong, Y., Labarthe, D., Mozaffarian, D., Appel, L.J., Van Horn, L., … Rosamond, W.D. (2010). Defining and setting National goals for cardiovascular health promotion and disease reduction. The American Heart Association's strategic impact goal through 2020 and beyond. *Circulation, 121*(4), 586-613. doi:10.1161/CIRCULATIONAHA.109.192703

Lozano, R., Naghavi, M., Foreman, K., Lim S., Shibuya, K., Aboyans, V., … Murray, C.J.L. (2012). Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: A systematic analysis for the Global Burden of Disease Study 2010. *Lancet, 380*(9859), 2095-2128. doi:10.1016/S0140-6736(12)61728-0.

Maas, A.H.E.M., & Appelman, Y.E.A. (2010). Gender differences in coronary heart disease. *Netherlands Heart Journal, 18*(12), 598-603. doi: 10.1007/s12471-010-0841-y.

Mackay, J., & Mensah, G. (2017). *The Atlas of Heart Disease and Stroke*. Retrieved from: http://www.who.int/cardiovascular_diseases/resources/atlas/en/

Mackay, M.H., Ratner, P.A., Johnson, J.L., Humphries, K.H., & Buller, C.E. (2011). Gender differences in symptoms of myocardial ischaemia. *European Heart Journal, 32*(24), 3107-3114. doi:10.1093/eurheartj/ehr358

Mahmood, S.S., Levy, D., Vasan, R.S., & Wang, T.J. (2014). The Framingham Heart Study and the epidemiology of cardiovascular diseases: A historical perspective. *Lancet, 383*(9921), 999–1008. doi:10.1016/S0140-6736(13)61752-3.

Marks, D., Murray, M., Evans, B., & Vida-Estacio, E. (2011). *Health Psychology. Theory, research, and practice.* London: SAGE.

Mathers, C., Fat, D., & Boerma, J.T. (2008). *The global burden of disease: 2004 update*. World Health Organization.

McCarthy, M.M., Dickson, V.V., & Chyun, D. (2011). Barriers to cardiac rehabilitation in women with cardiovascular disease. An integrative review. *Journal of Cardiovascular Nursing, 26*(5), e1-e10. doi: 10.1097/JCN.0b013e3181f877e9

McCreery, C., Cradock, K., Fallon, N., Duffy, R., O'Doherty, V., & Kingston, C. (2013). *Cardiac rehabilitation guidelines 2013. Dublin: Irish Association of Cardiac Rehabilitation*. Retrieved from http://www.iacr.info/wp-content/uploads/2015/03/IACR-Guidelines2013.pdf

Mendis, S., Puska, P., & Norrving, B. (Eds). (2011). *Global Atlas on Cardiovascular Disease Prevention and Control*. Retrieved from http://www.who.int/cardiovascular_diseases/publications/atlas-cvd/en/ Accessed on November 11, 2017.

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D.G., on behalf of PRISMA Group. (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Annals of Internal Medicine, 151*(4), 264-269. doi:10.7326/0003-4819-151-4-200908180-00135

Mosca, L., Banka, C.L., Benjamin, E.J., Berra, K., Bushnell, C., Dolor, R.J., … Wenger, N.K. (2007). Evidence-based guidelines for cardiovascular disease prevention in women: 2007 update. *Circulation, 115*(11), 1481-1501. doi: 10.1161/CIRCULATIONAHA.107.181546

Mosca, L., Barrett-Connor, E., & Wenger, N.K. (2011). Sex/Gender differences in cardiovascular disease prevention. What a difference a decade makes. *Circulation, 124*(19), 2145-2154. doi:10.1161/CIRCULATIONAHA.110.968792.

Mosca, L., Benjamin, E.J., Berra, K., Benzanson, J.L., Dolor, R.J., Lloyd-Jones, D.M., … Wenger, N.K. (2011). Effectiveness-Based guidelines for the prevention of cardiovascular disease in women – 2011 update: A Guideline from the American Heart Association. *Circulation, 123*(11), 1243-1262. doi:10.1161/CIR.0b013e31820faaf8

Mosca, L., Grundy, S.M., Judelson, D., King, K., Limacher, M., Oparil, S., … Zinberg, S. (1999). Guide to Preventive Cardiology for Women. AHA/ACC Scientific Statement Consensus panel statement. *Circulation, 99*(18), 2480-2484. doi:10.1161/01.CIR.99.18.2480

Mosca, L., Hammond, G., Mochari-Greenberger, H., Towfighi, A., & Albert, M.A. (2013). Fifteen-year trends in awareness of heart disease in women results of a 2012 American Heart Association National Survey. *Circulation, 127*(11), 1254-1263. doi:10.1161/CIR.0b013e318287cf2f/-/DC1.

Mosca, L., Jones, W.K., King, K.B., Ouyang, P., Redberg, R.F., & Hill, M.N. (2000). Awareness, perception, and knowledge of heart disease risk and prevention among women in the United States. *Archives of Family Medicine, 9*(6), 506-515.

Motivala, A.A., Cannon, C.P., Srinivas, V.S., Dai, D., Hernández, A.F., Peterson, E.D., … Fonarow, G.C. (2011). Changes in myocardial infarction guideline adherence as a function of patient risk. An end to paradoxical care? *Journal of the American College of Cardiology, 58*(17), 1760-1765. doi:10.1016/j.jacc.2011.06.050

Muka, T., Oliver-Williams, C., Kunutsor, S., Laven, J.P.S., Fauser, B.C.J.M., Chowdhury, R., … Franco, O.H. (2016). Association of age at onset of menopause and time since onset of menopause with cardiovascular outcomes, intermediate vascular traits, and all-cause mortality. A systematic review and meta-analysis. *JAMA Cardiology, 1*(7), 767-776. doi:10.1001/jamacardio.2016.2415

Neubeck, L., Freedman, S.B., Clark, A.M., Briffa, T., Bauman, A., & Redfern, J. (2012). Participating in cardiac rehabilitation: A systematic review and meta-synthesis of qualitative data. *European Journal of Preventive Cardiology, 19*(3) 494-503. doi:10.1177/1741826711409326

National Institute for Health and Care Excellence. (2015). Secondary prevention after a myocardial infarction. NICE guideline. Retrieved from: https://www.nice.org.uk/guidance/qs99

Nichols, M., Townsend, N., Scarborough, P., & Rayner, M. (2014). Cardiovascular disease in Europe 2014: Epidemiological update. *European Heart Journal, 35*(42), 2950–2959. doi:10.1093/eurheartj/ehu299

Oosenbrug, E., Marinho, R.P., Zhang, J., Marzolini, S., Colella, T.J.F., Pakosh, M., & Grace, S.L. (2016). Sex differences in cardiac rehabilitation adherence: A meta-analysis. *Canadian Journal of Cardiology, 32*(11), 1316-1324. doi:10.1016/j.cjca.2016.01.036

Oxman, A.D., & Guyatt, G.H. (1993). The science of reviewing research. *Annals of the New York Academy of Sciences*, *703*, 125-133.

Patel, H., Rosengren, A., & Ekman, I. (2004). Symptoms in acute coronary syndromes: Does sex make a difference? *American Heart Journal, 148*(1), 27-33. doi:10.1016/j.ahj.2004.03.005

Perk, J., De Backer, G., Gohlke, H., Graham, I., Reiner, Z., Verschuren, M., … Zannad, F. (2012). European Guidelines on cardiovascular disease prevention in clinical practice (version 2012). The Fifth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in

Clinical Practice (constituted by representatives of nine societies and by invited experts). *European Heart Journal, 33*(13), 1635-1701. doi: 10.1093/eurheartj/ehs092.

Peters, S.A., Huxley, R.R., & Woodward, M. (2013). Comparison of the sex-sepecific associations between systolic blood pressure and the risk of cardiovascular disease: a systematic review and meta-analysis of 124 cohort studies including 1.2 milion individuals*. Stroke 44*(9) 2394-2401. doi:10.1161/STROKEAHA.113.002342

Piepoli, M.F., Corrà, U., Adamopoulos, S., Benzers, W., Bjarnason-Wehrens B., Cupples, M., … Giannuzzi, P. (2014). Secondary prevention in the clinical management of patients with cardiovascular diseases. Core components, standards and outcome measures or referral and delivery: A policy statement from the cardiac rehabilitation section of the European Association for Cardiovascular prevention & Rehabilitation. Endorsed by the Committee for Practice Guidelines of the European Society of Cardiology. *European Journal of Preventive Cardiology, 21*(6), 664-681. doi: 10.1177/2047487312449597

Pimenta, E. (2012). Hypertension in women. *Hypertension Research, 35*(2), 148-152. doi:10.1038/hr.2011.190

Pogosova, N., Kotseva, K., De Bacquer, D., von Känel, R., De Stmedt, D., Bruthans, J., … Dolzhenko, M., on behalf of the EUROASPIRE Investigators (2017). Psychosocial risk factors in relation to other cardiovascular risk factors in coronary heart disease: Results from the EUROASPIRE IV survey. A registry from the European Society of Cardiology. *European Journal of Preventive Cardiology, 24*(13), 1371-1380. doi:10.1177/2047487317711334

Price, K.J., Gordon, B.A., Bird, S.R., & Benson, A.C. (2016). A review of guidelines for cardiac rehabilitation exercise programmes: Is there an international consensus? *European Journal of Preventive Cardiology, 23*(16), 1715-1733. doi:10.1177/2047487316657669

Raeisi-Giglou, P., Volgman, A.S., Patel, H., Campbell, S., Villablanca, A., & Hsich, E. (2018). Advances in cardiovascular health in women over the past decade: Guideline recommendations for practice. *Journal of Women's Health, 27*(2), 128-139. doi:10.1089/jwh.2016.6316.

Rawstorn, JC.., Gant, N., Direito, A., Beckmann, C., & Maddison, R. (2016). Telehealth exercise-based cardiac rehabilitation: A systematic review and meta-analysis. *Heart, 102*(15), 1183-1192. doi:10.1136/heartjnl-2015-308966

Regitz-Zagrosek, V., Oertelt-Prigione, S., Prescott, E., Franconi, F., Gerdt, E., Foryst-Ludwig, A., … Stangl, V. (2016). Gender in cardiovascular diseases: Impact on clinical manifestations, management, and outcomes. *European Heart Journal, 37*(1), 24-34. doi:10.1093/eurheartj/ehv598

Roger, V.L., Go, A.S., Lloyd-Jones, D.M., Adams, R.J., Berry, J.D., Brown, T.D., … Wylie-Rosett, J. (2011). Heart Disease and Stroke Statistics—2011 Update. A Report From the American Heart Association. *Circulation, 123*(4), e18-e209. doi: 10.1161/CIR.0b013e3182009701

Rosengren, A., Hawken, S., Ounpuu, S., Sliwa, K., Zubaid, M., Almahmeed, WA., … Yusuf, S., on behalf of INTERHEART Investigators. (2004). Association of psychosocial risk factors with risk of acute myocardial infarction in 11119 cases and 13648 controls from 52 countries (the INTERHEART study): case-control study. *Lancet, 364*(9438), 953-962. doi:10.1016/S0140-6736(04)17019-0

Roth, G.A., Johnson, C., Abajobir, A., Abd-Allah, F., Abera, S.F., Abyu, G., … Murray, C. (2017). Global, Regional, and National Burden of Cardiovascular Diseases for 10 Causes, 1990 to 2015. *Journal of the American College of Cardiology, 70*(1), 1-25. doi: 10.1016/j.jacc.2017.04.052.

Ruano-Ravina, A., Pena-Gil, C., Abu-Assi, E., Raposeiras, S., van't Hof, A., Meindersma, E., … González-Juanatey, J.R. (2016). Participation and adherence to cardiac rehabilitation programs. A systematic review. *International Journal of Cardiology, 223*(15), 436-443. Doi: 10.1016/j.ijcard.2016.08.120

Samayoa, L., Grace, S.L., Gravely, S., Scott, L.B., Marzolini, S., & Colella, T.J.F. (2014). Sex differences in cardiac rehabilitation enrollment: A meta-analysis. *Canadian Journal of Cardiology, 30*(7), 793-800. doi:10.1016/j.cjca.2013.11.007

Santiago de Araújo Pío, C., Marzolini, S., Pakosh, M., & Grace, S.L. (2017). Effect of cardiac rehabilitation dose on mortality and morbidity: A systematic review and meta-regression analysis. *Mayo Clinical Proceedings, 92*(11), 1644-1659. doi:10.1016/j.mayocp.2017.07.019

Scott, L.B., & Allen, J.K. (2004). Providers' perceptions of factors affecting women's referral to outpatient cardiac rehabilitation programs. An exploratory study. *Journal of Cardiopulmonary Rehabilitation, 24*(6), 387-391.

Scott, L.B., Ben-Or, K, & Allen, J.K. (2002). Why Are Women Missing from Outpatient Cardiac Rehabilitation Programs? A Review of Multilevel Factors Affecting Referral, Enrollment, and Completion. *Journal of Women's Health, 11*(9), 773-791.

Shaw, R.L., Larkin, M., & Flowers, P. (2014). Expanding the evidence within evidence-based healthcare: Thinking about the context, acceptability and feasibility of interventions. *Evidence Based Medicine, 19*(6), 201-203. doi:10.1136/eb-2014-101791

Sidney, S., Quesenberry, C.P., Jaffe, M.G., Sorel, M., Nguyen-Huynh, M.N., Lawrence, H., … Rana, J.S. (2016). Recent trends in cardiovascular mortality in the United States and public health goals. *JAMA Cardiology, 1*(5), 594-599. doi:10.1001/jamacardio.2016.1326

Smith, S.C., Benjamin, E.J., Bonow, R.O., Braun, L.T., Creager, M.A., Franklin, B.A., … Taubert, K.A. (2011). AHA/ACCF Secondary prevention and risk reduction therapy for patients with coronary and other atherosclerotic vascular disease: 2011 update. *Journal of the American College of Cardiology 58*(23) 2432-2446. doi:10.1016/j.jacc.2011.10.824

Suaya, J.A., Shepard, D.S., Normand, S.T., Ades, P.A., Prottas, J., & Stason, W.B. (2007). Use of cardiac rehabilitation by Medicare beneficiaries after myocardial infarction or coronary bypass surgery. *Circulation, 116*(15), 1653-1662. doi:10.1161/CIRCULATIONAHA.107.701466

Supervía, M., Medina-Inojosa, J.R., Yeung, C., López-Jiménez, F., Squires, R.W., Pérez-Terzic, C.M., … Thomas, R.J. (2017). Cardiac rehabilitation for women: A systematic review of barriers and solutions. *Mayo Clinical Proceedings, 92*(4), 565-577. doi:10.1016/j.mayocp.2017.01.002

Taylor, G.H., Wilson, S.L., & Sharp, J. (2011). Medical, psychological, and sociodemographic factors associated with adherence to cardiac rehabilitation programs. A systematic review. *Journal of Cardiovascular Nursing, 26*(3), 202-209. doi:10.1097/JCN.0b013e3181ef6b04

Taylor, R.S., Dalal, H., Jolly, K., Zawada, A., Dean, S.G., Cowie, A., & Norton, R.J. (2015). Home-based versus centre-based cardiac rehabilitation. *Cochrane Database Systematic Review, 18*(8), CD007130. doi:10.1002/14651858.CD007130.pub3.

Teo, K., Lear, S., Islam, S., Mony, P., Dehghan, M., Li, W., … Yusuf, S. (2013). Prevalence of a Healthy Lifestyle Among Individuals With Cardiovascular Disease in High-, Middle- and Low-Income Countries The Prospective Urban Rural Epidemiology (PURE) Study. *JAMA, 309*(15), 1613-1621. doi:10.1001/jama.2013.3519.

Thomas, R.J., King, M., Lui, K., Oldridge, N., Piña, I.L., Spertus, J., … Shahian, D.M. (2010). AACVPR/ACCF/AHA 2010 Update: Performance Measures on Cardiac Rehabilitation for Referral to Cardiac Rehabilitation/Secondary Prevention Services. A Report of the American Association of Cardiovascular and Pulmonary Rehabilitation and the American College of Cardiology Foundation/American Heart Association Task Force on Performance Measures (Writing Committee to Develop Clinical Performance Measures for Cardiac Rehabilitation). *Circulation, 122*(13), 1342-1350. doi:10.1161/CIR.0b013e3181f5185b

Tong, A., Sainsbury, P., & Craig, J. (2007). Consolidated criteria for reporting qualitative research (COREQ): A 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care, 19*(6),349-357. doi: 10.1093/intqhc/mzm042

Townsend, N., Wilson, L. Bhatnagar, P., Wickramasinghe, K., Rayner, M., & Nichols, M. (2016). Cardiovascular disease in Europe: Epidemiological update 2016. *European Heart Journal, 37*(42), 3232-3245. doi:10.1093/eurheartj/ehw334

Tunstall-Pedoe, H., Kuulasmaa, K., Mähonen, M., Tolonen, H., Ruokokoski, E., & Amouyel, P. (1999). Contribution of trends in survival and coronary event rates to changes in coronary heart disease mortality: 10-year results from 37 WHO MONICA Project populations. Monitoring trends and determinants in cardiovascular disease. *Lancet, 353*(9164), 1547-1557.

Turk-Adawi, K.I., & Grace, S.L. (2015). Narrative Review Comparing the Benefits of and Participation in Cardiac Rehabilitation in High-, Middle- and Low-Income Countries. *Heart, Lung and Circulation, 24*(5), 510-520. doi:10.1016/j.hlc.2014.11.013

Turk-Adawi, K.I., Sarrafzadegan, N., & Grace, S.L. (2014). Global availability of cardiac rehabilitation. *Nature Reviews Cardiology, 11*(10), 586-596. doi:10.1038/nrcardio.2014.98

United Nations. (2018). https://sustainabledevelopment.un.org/sdg3 Accesed on April 28, 2018.

Vanhees, L., McGee, H.M., Dugmore, L.D., Schepers, D. & van Daele, P. (2002). A representative study of cardiac rehabilitation activities in European Union Member States: The CARINEX SURVEY. *Journal of Cardiopulmonary Rehabilitation and Prevention, 22*(4), 264-272.

Watkins, L.L., Koch, G.G., Sherwood, A., Blumenthal, J.A., Davidson, J.R., O'Connor, C., & Sketch, M.H. (2013). Association of anxiety and depression with all-cause mortality in individuals with coronary heart disease. *Journal of American Heart Association, 19*(2), e000068. doi:10.1161/JAHA.112.000068.

Wellons, M., Ouyang, P., Schreiner, P.J., Herrington, D.M., & Vaidya, D. (2012). Early menopause predicts future coronary heart disease and stroke: The multi-ethnic study of atherosclerosis (MESA). *Menopause, 19*(10), 1081–1087. doi:10.1097/gme.0b013e3182517bd0

Wilkins, E., Wilson, L., Wickramasinghe, K., Bhatnagar, P., Leal, J., Luengo-Fernandez, R., … Townsend, N. (2017). *European Cardiovascular Disease Statistics 2017*. European Heart Network: Brussels

Witt, B.J., Thomas, R.J., & Roger, V.L. (2005). Cardiac rehabilitation after myocardial infarction: A review to understand barriers to participation and potential solutions. *Europa Medicophysica, 41*(1), 27-31.

Women's Health. (1985). Report of the Public Health Service Task Force on Women's Health Issues. *Public Health Reports*, *100*(1), 73–106.

Wong, N.D. (2015). Epidemiology and prevention of cardiovascular disease. In R. Detels, M. Gulliford, QA. Karim, & CC. Tan (Eds.), *Oxford Textbook of Global Public Health, 6th edition* (pp. 909-922). United Kingdom: Oxford University Press.

World Health Organization (2017a). http://www.who.int/mediacentre/factsheets/fs317/en/ Accessed June 06, 2017

World Health Organization (2017b). http://www.who.int/gho/ncd/en/ Accessed November 14, 2017

World Health Organization (2017c). http://www.who.int/topics/risk_factors/en/ Accessed October 24, 2017

World Health Organization (2017d). *Monitoring tobacco use and prevention policies*. Geneva: World Health Organization.

World Health Organization (2017e). Depression and other common mental disorders: Global health estimates. Retrieved from: http://www.who.int/mental_health/management/depression/prevalence_global_health_estimates/en/

Wormser, D., Kaptoge, S., Di Angelantonio, E., Wood, A.M., Pennells, L., Thompson, A., … Danesh, J. (2011). Separate and combined associations of body-mass index and abdominal adiposity with cardiovascular disease: Collaborative analysis of 58 prospective studies. *Lancet, 377*(9771), 1085-1095. doi: 10.1016/S0140-6736(11)60105-0

Wyer, S., Joseph, S., & Earll, l. (2001). Predicting attendance at cardiac rehabilitation: A review and recommendations. *Coronary Health Care, 5*(4),171-177. doi:10.1054/chec.2001.0139

Yusuf, S., Steven, H., Ôunpuu, S., Dans, T., Avezum, A., Lanas, F., … Lisheng, L., on behalf of the INTERHEART Study Investigators (2004). Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): Case-control study. *The Lancet*, *364*(9438), 937-952. doi:10.1016/S0140-6736(04)17018-9

Brief curriculum vitae

1. Publications

Resurrección, D.M., Moreno-Peral, P., Gómez-Herranz, M., Rubio-Valera, M., Pastor, L., Caldas de Almeida, J.M., & Motrico, E. (2018). Factors associated with nonparticipation in and dropout from cardiac rehabilitation programs: A systematic review of prospective cohort studies. *European Journal of Cardiovascular Nursing, 18,* 1-10. doi:10.1177/1474515118783157

Resurrección, D.M., Motrico, E., Rigabert, A., Rubio-Valera, M., Conejo-Cerón, S., Pastor, L., & Moreno-Peral, P. (2017). Barriers for Nonparticipation and Dropout of Women in Cardiac Rehabilitation Programs: A Systematic Review. *Journal of Women's Health, 26*(8), 849-859. doi:10.1089/jwh.2016.6249

Resurrección, D.M., Salguero, J.M., & Ruiz-Aranda, D. (2014). Emotional intelligence and psychological maladjustment in adolescence: A systematic review. *Journal of Adolescence, 37*, 461-472. doi: 10.1016/j.adolescence.2014.03.012

Resurrección, D.M., Motrico, E., Rubio-Valera, M, Mora-Pardo, J.A., & Moreno-Peral, P. Reasons for dropout from cardiac rehabilitation programs in women: A qualitative study. *PlosOne* (minor changes)

Rigabert, A., Motrico, E., Moreno-Peral, P., Resurrección, D.M., Conejo-Cerón, S., Navas-Campaña, D., & Bellón, J.A. Effectiveness of online interventions in preventing depression: A protocol for systematic review and meta-analysis of randomized controlled trials. *BMJ Open*, (minor changes)

2. Book chapters

Resurrección, D.M., Ruiz-Aranda, D., & Salguero-Noguera, J.M. (2016). Depresión y adolescencia: un análisis de los factores implicados. En JL. Soler, L. Aparicio, O. Díaz, E. Escolano, & A. Rodríguez (Coord.), *Inteligencia emocional y Bienestar II: Reflexiones, experiencias profesionales e investigaciones* (pp. 722-742). Zaragoza: Ediciones Universidad San Jorge.

3. Conference papers

Resurrección, D.M., Motrico, E., Rigabert, A., Moreno-Peral, P., Conejo-Cerón, S., Rubio-Valera, M., … Pastor, L. (2016). Barriers associated with nonparticipation of women in cardiac rehabilitation programs: A systematic review. *European Heart Journal, 37,* 1121-1122.

4. Congress

Gómez-Herranz, M., Galvao-Carmona, A., Resurrección, D.M., Motrico, Emma; Vega-Salvatierra, Á., …Montaner-Villalonga, J. (2017). *Deterioro cognitivo y síntomas depresivos en pacientes con Fibrilación Auricular e infartos cerebrales encubiertos.* Presented at the III Jornadas doctorales de la Universidad de Murcia, Murcia.

Gómez-Herranz, M., Galvao-Carmona, A., Resurrección, D.M., Motrico, E., Vega-Salvatierra, Á., Mancha-Molina, F., … Montaner-Villalonga, J. (2017). *Evaluación neuropsicológica en pacientes con fibrilación auricular e infartos cerebrales silentes*. Presented at the XIII Congreso Andaluz de Neuropsicología (SANP), Huelva.

Resurrección, D.M., Motrico, E., Rigabert, A., Moreno-Peral, P. Conejo-Cerón, S., Rubio-Valera, M., … Pastor, L. (2016). *Barriers associated with nonparticipation of women in cardiac rehabilitation programs: A systematic review*. Presented at the Congress of the European Society of Cardiology, Rome.

Resurrección, D.M., Motrico, E., Rigabert, A., Moreno-Peral, P., Conejo-Cerón, S., Rubio-Valera, M., … Gómez-Jiménez, M.P. (2016). *Barreras asociadas a la baja participación de la mujer en los programas de rehabilitación cardíaca: Evaluación con métodos mixtos (Estudio PARTICIPA)*. Presented at the III Congreso internacional de investigación en Salud y Envejecimiento and I Congreso internacional de investigación en Salud, Almería.

Rigabert, A., Motrico, E., Resurrección, D.M., Conejo-Cerón, S., Moreno-Peral, P., Navas-Campaña, D., & Bellon-Saameño, J.A. (2016). *Effectiveness of online interventions to prevent depression: Systematic review and meta-analysis of randomized controlled trials.* Presented at the III Congreso internacional de investigación en Salud y Envejecimiento and I Congreso internacional de investigación en Salud, Almería.

5. Participation in projects

Learning to be: Developing of Practices and Methodologies for Assessing Social, Emotional and Health skills within Education Systems /Learn2B. 582955-EPP-1-2016-2-LT-EPPKA3-PI-POLICY

ERASMUS+ Key Action 3: European Policy Experimentations.

Evaluación neuropsicológica en pacientes con fibrilación auricular y alto riesgo de infartos cerebrales encubiertos. Universidad Loyola Andalucía

Proyecto INTEDI: Intervención en habilidades emocionales en adolescentes con diabetes mellitus tipo 1. Universidad Loyola Andalucía

6. Other relevant merits

V Premio joven a la cultura científica en la modalidad "Investigadores de grado y post grado", en el ámbito de las Ciencias Humanas y Sociales. "Factores asociados a la baja participación de la mujer en los programas de rehabilitación cardíaca: Evaluación con métodos mixtos (Estudio PARTICIPA). Recibido en Sevilla, 2018.

Internship at CEDOC – Chronic Diseases Research Center, Lisbon, Portugal. From 14/04/2017 to 14/08/2017.

Internship at CEDOC – Chronic Diseases Research Center, Lisbon, Portugal. From 02/01/2018 to 02/02/2018.